USER MANUAL

Series KU
Series KEK

Modular
Ceiling
Pool
Hygienic
ATEX

Publication : **UPM-KU-V06-EN**

EN

	IT IS RECOMMENDED TO KEEP THIS USER MANUAL IN THE VICINITY OF THE UNIT AND WITHIN REACH OF THE AUTHORIZED PERSONNAL RESPONSIBLE FOR MAINTENANCE!

PROKLIMA

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This manual represents the state of technology in time of writing. As the printed version is reviewed periodically, before usage please provide a last version of manual, by downloading from our web site www.proklima.hr.

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1 SAFETY, TRANSPORT, STORAGE

1.1 PREFACE, CAUTIONS AND WARNINGS

This manual describes proper installation, operation and maintenance procedures for air handling units. By carefully reviewing the information within this manual and by following the instructions, the risk of improper operation and/or component damage will be minimized. This manual is intended for use by authorized operating and service personnel, who should possess the appropriate training and skills to perform their tasks professionally and safely.

Your personal safety and proper operation of unit depend upon the strict observance of following precautions and safety signs:

DANGER	Indicates imminent hazardous situation which, if not avoided, will result in death or serious injury.

CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTICE	Provides, highlight and clarify additional information, remark or suggestion

1.2 GENERAL

NOTICE

This instruction manual is to be kept in the vicinity of the unit and within reach of the maintenance personnel!

This manual complies with EC Council Directive 2006/42/EC Machinery Directive

To be read in conjunction with relevant product documentation.

Responsible person on site carrying out the installation or replacement of the unit or its components, or is connecting the unit to different automatic control equipment (not delivered by the Manufacturer) is fully responsible for checking the unit conformity, provide the declaration of conformity and put appropriate marks (CE mark) according to relevant EC Council Directives, guidelines and local rules.

Before performing any task, maintenance personnel should carefully read and understood this manual together with all other related documents.

The connecting and commissioning of the unit are to be carried out under conditions that are in conformity with relevant regulations, especially those valid in the field of electrical devices.

Installation, electrical connection and commissioning are only to be carried out by authorized personnel and in accordance with requirements and demands. Electrical connection must be done according to the wiring diagrams, instructions and marking on terminal boxes, wires or other relevant documents attached.

The main power supply must **not be turned** on before the unit has been connected to the safety system and grounded.

It is forbidden to carry out service and maintenance operations if the power supply **is not disconnected**.

It is forbidden to operate the unit if some parts of casings have been dismounted from individual components or sections.

The maintenance and service personnel must be adequately qualified and have valid work permits issued by the competent authority.

The service area must be equipped with all necessary protective equipment (emergency exits, first-aid-box, fire-extinguisher, etc.) to guarantee personal safety during maintenance operations.

Beware of the safety instructions provided by the manufacturers of individual components!

Units marked with the Ex mark (referred as ATEX units) are suited for use in accordance with the ATEX directive, Directive 94/9/EC, in the specified explosion hazard areas as marked on their nameplate and in their technical data sheet. Be sure to observe any restrictions on use.

The ATEX unit is designed according to the restrictions on use given by the costumer. The air handling unit is a single component and cannot guarantee by itself the complete and comprehensive explosion protection. The protection concept concerns the whole plant. The user or respectively the plant constructor is fully responsible for the explosion protection safety measurements.

Scope of usage:

ATEX units must **not be** used near:

- High-frequency sources (e.g. transmitters),
- Strong light sources (e.g. lasers),
- Ionizing radiation sources (e.g. X-ray tubes),
- Ultrasound sources (e.g. ultrasound echo testing equipment)

Do not commission ATEX units until the following requirements are met:

- Conditions of use in accordance with the purpose for which the unit is intended,
- No substances nearby that are prone to spontaneous combustion (pyrophoric substances) under EN 1127-1
- Constant and adequate ventilation of the installation site (control room) in the case of ATEX units without a specified exterior ex zone so that unavoidable leakage to the exterior of the unit does not result in an explosive atmosphere

.

All units and components must be transported and kept on appropriate way to avoid damage, consequences of atmospheric conditions, condensing (ensure proper ventilation of packed unit).On storage of units longer than 3 months and before start-up, at least once a month, turn on or spin manually all rotating parts on fans, motors, pumps, recuperators etc. If the device is delivery in several dispatchment units, all of them should be assembled together according to assembly instructions, and all protective devices should be mounted and active.

Person responsible for installation work on site is obligated to finish the installation work and getting the device into the readiness for work, and is responsible for labeling with CE mark and providing the EC declaration of conformity (valid for units delivered on EU territory).

1.3 SAFETY FEATUERES

Unit **CAN NOT WORK** (unless is stated differently in technical documentation):

- on places with high risk of explosive atmospheres (except ATEX units, according to separate specifications),
- near the high magnetic fields,
- on air with dust, aggressive gases or chemical particles or ambient temperature is less than -25 ^{o}C or greater than + 60 ^{o}C
- where maximal absolute air humidity is exceeding the limit of 18 g/kg of dry air, depending on temperature,
- temperature of outside air is less than -25 ^{o}C or greater than + 60 ^{o}C
- temperature of extract air is less than 0 ^{o}C or greater than + 60 ^{o}C

Access or work on the unit when the following conditions are fulfilled:

- Wear protective clothes,
- Disconnect the unit from the power supply
- Wait for minimal 15 minutes after disconnecting the frequency converter (because the residual voltage),
- Protection from accidental switch on is active (according to EN 60204) for e.g. locked service switch
- All rotating or moving parts are in standstill, especially the fan rotor, belt drive, motor, rotary heat exchanger etc.
- Coils and pump group on room temperature,
- Pressurized bearing systems without the pressure.

After the installation, service or maintenance work is finished and before commissioning, please do the following:

- Protective devices must be mounted and functional (acc. to DIN EN 294) for e.g. protective grill,
- Check no personal in protective zone around the unit or inside the unit
- Installation work is done by authorized and competent personal

Manufacturer is not responsible for damage caused by improper use. For all damages on unit or to third party the risk is transferred to the end user Changes on the unit are not allowed without manufacturers consent. Use only original spare parts or parts approved by the manufacturer. Otherwise, manufacturer is not responsible for correct operation of the unit and warranty claims will be not valid.

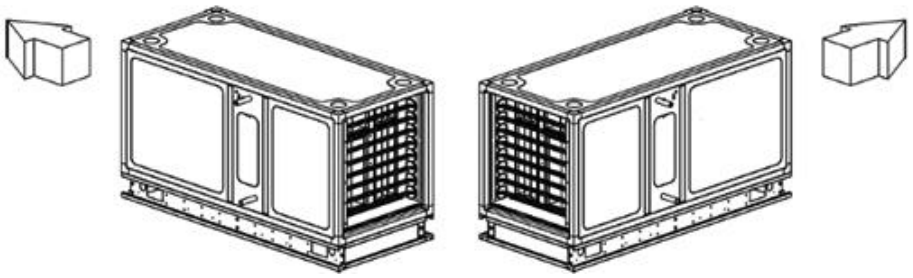
1.4 SCOPE

This installation and maintenance manual refers to air-handling units (hereinafter referred to as: units) of KU and KEK types manufactured by PROKLIMA (hereinafter referred to as: the manufacturer). It contains basic data about the design, methods and rules of installation, preparation and starting up of the unit, including recommendations for a regular maintenance.

The units of KU and KEK types are used as air treatment units in ventilation and air-conditioning systems of industrial, business, sports and similar applications. The size of the units is determined by the air volume flow rate range from 800 to 130.000 m3/h (on air density of 1.2 kg/m3). Unit is used for mixing, filtering, heating, cooling, humidification or dehumidification of air, sound attenuation, heat recovery, etc.

1.5 ACCESS SIDES

The access to the unit components may be provided on the left or on the right side of the unit, depending on the direction of airflow and the position of the access doors, pipe connections, condensate drains, etc.



LEFT ACCESS SIDE (L) **RIGHT ACCESS SIDE (R)**

On stocked and side-by-side units the access side depends on the direction of airflow in the supply unit.

On vertically designed units the access side is determined by a special agreement or rather an isometric sketch.

1.6 TRANSPORT, UNLOADING AND STORAGE

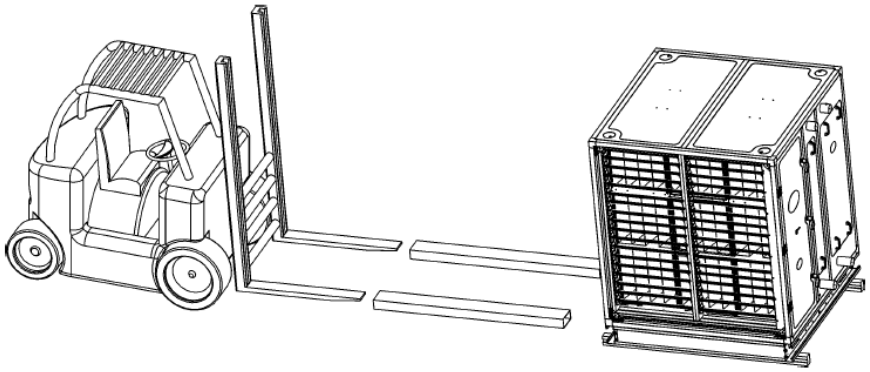
The units are supplied in one or more delivery sections or fully disassembled (on request). This manual does not contain instructions or recommendations for installation of units supplied fully disassembled. In such a case please consult the manufacturer.

Each section is covered by protective transparent foil. All unit sections contain an assembly plan and information about weights of individual delivery sections. Assembly kit, additional manuals and connection diagrams of components (like motors, steam humidifier, burners etc.) are packed in carton boxes and putted inside the unit. Sections with additional parts inside are marked with appropriate label.

After receipt of the unit on site, packing and attached documentation should be checked, together with completeness of delivered parts and assembly kit.

Sections should be unloaded from the vehicle and conveyed into the building by a forklift or a crane. In order to facilitate forklift handling and protect unit from damage, the delivery sections without a base frame are placed on wooden pallets.

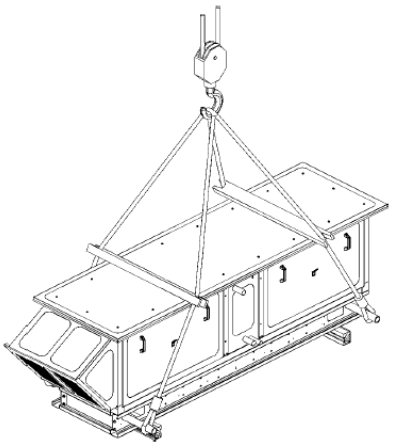
In case that forklift forks are too short to handle a delivery section, forklift bar extensions of a corresponding length must be applied (see the illustration).

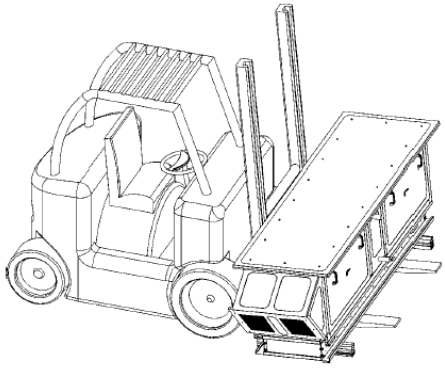


DANGER Please do not overlap the unit vertically or horizontally. Do not stack for lifting or storage. Forklift operator should be qualified and have valid forklift driving permission.

The crane transfer should be carried out by means of steel ropes of equal length and spreader bars wide enough to avoid damaging the unit casing (see the illustration). For crane transfer the lifting holes made in the unit base frame (as standard) or lifting brackets (fitted on a special request of the customer) are used.

- Lift the unit one-by-one, with no additional loads,
- Beware of package center of mass to avoid unit slipping,
- Never attached hooks on unit components like openings, dampers but on appropriate places on baseframe,
- For lifting use crane with appropriate load capacity,
- Steel strings should not be damaged, intricate or exposed to sharp edges





DANGER Lifting of unit near people increase the risk and danger of falling the unit causing severe injury or death. Please secure the area from personnel attendance or take other necessary precautions to avoid or reduce the risk of injury or death.

The units may only be transported in the fitting position and properly fastened to prevent them from shifting during transportation. The manufacturer's warranty does not cover any damage caused by inadequate transportation, inexpert unloading or inappropriate storage. All complaints about damage should be submitted to the transporter or the warehouse manager.

The sections must not be stacked. All the sections supplied are to be stored in an area that meets the following requirements:

- the maximum permissible air humidity does not exceed 80% at a temperature of 20°C, maximal absolute air humidity is under the limit of 18 g/kg of dry air, depending on temperature,
- the ambient temperature between -10°C and +40°C
- dust, aggressive gases or chemicals causing corrosion of unit components and casing must not come into contact with the unit

In case of a long storage periods, protective foil used for packaging must be removed in order to prevent condensation.

Units of the outdoor design may be stored in the open air, but must be protected by a moisture-proof cover. It is necessary to take all measures to prevent condensation and ensure natural ventilation under the cover.

It is recommended to keep the unit in original packing. Remove the packing foil before the assembly. Preserve the unit from atmospheric conditions (wind, direct sunlight, rain, snow, ice).

Units must be transported on appropriate way, to avoid damages, atmospheric conditions or condensation (ensure natural ventilation under the cover). If the unit is stored for a period longer than 3 months before assembly, please turn on or manually rotate the fan rotor, motor, pumps, rotary heat exchangers etc. at least once a month.

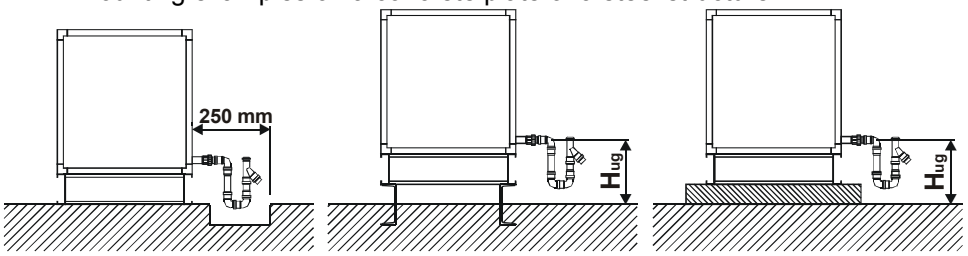
If the unit is delivered in separate delivery sections and before commissioning, it is necessary to assemble it in whole according to this manual. Install the protection and safety devices.

1.7 UNIT PLACEMENT

The unit should be laid on a concrete base plate or a specially fabricated and reasonably sturdy steel structure. The foundation or rather the steel structure must be aligned and leveled by a spirit-level to ensure that the unit leaning on the platform and rubber washers is resting over the entire width with no deformation. The fundament and the unit base height must facilitate free mounting of a corresponding siphon, drains, etc. When air washers are delivered, the unit must be installed in such a manner to ensure the alignment of top sides (surfaces) of all sections.

NOTICE For determination of the minimal height of the base plate or steel structure please contact the manufacturer

Mounting examples on a concrete plate or a steel structure:



The recommended minimum distance between the siphon connection and the base Hug equals the height of the siphon mounted (see Chapter 2.7) increased by 2 widths of the siphon mounted (2 x ϕ D) and the height of the steel structure or the concrete base plate.

1.8 UNIT POSITIONING

When positioning the unit, enough free space should be reserved for connecting to the air duct system, hot / cold / fresh / process water piping and electrical installations. The unit must facilitate a smooth operation and easy maintenance of all built-in components (acc. to VDI 3803).

Maximal tolerance of horizontal unit inclination to base plate is 0,5 % (0.3^{o})

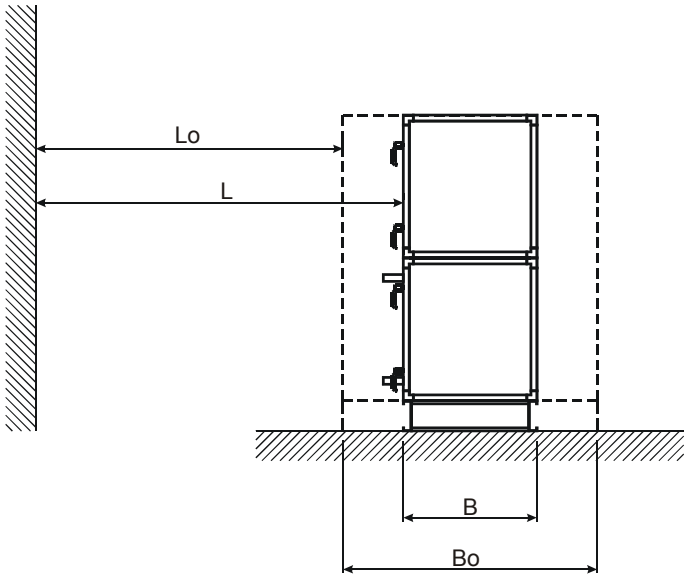
The minimum width of the free space on the access side must be as follows:

- for fan, filter and mixing unit L = B
- for heat exchangers (heaters, coolers)
- units with burners L=B+ 250
- for rotating heat exchanger unit Lo = Bo + 250

where:

B-means the unit width

Bo-means the rotary heat exchanger section width



Ensure min. 60 cm of free space from back side of the unit to the wall.

NOTICE In case of a side-by-side unit, appropriate free space for access to unit built-in components must be provided on both sides of the unit

The installation of piping, equipment and support components on the access side should enable a simple dismounting and mounting during maintenance and service.

PROTECTION OF UNIT AGAINST WIND BLASTS (OUTDOOR INSTALLATION)

Beware of direction and strength of wind blasts when installing the outdoor unit, especially stocked units. In case the unit is installed on a place with strong wind and/or wind blasts faster than 100 km/h, the unit should be additionally fastened to a concrete plate or steel structure.

All units where ratio of weight and surface of side area (burst) equals or are less than 153, are prone of slipping or overturning.

.

$$\frac{m\ (kg)}{A\ (m^2)} \leq 153$$

Beware to ensure such units from slipping or overturning.

Position the unit in a manner to point the smallest unit surface exposed to a strongest wind blast direction (front or back side). If not possible, it is recommended to install clutches or anchor baseframe to base plate on several places to protect unit from slipping or overturning.

1.9 UNIT ASSEMBLY

Before assembly of delivery sections into a whole read the assembly instructions carefully. Instructions and manuals are usually putted in fan section, together with assembly kit box.

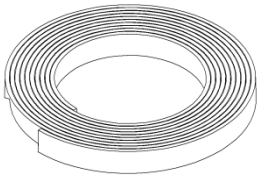
- remove the protective foil from all delivery sections
- remove the assembly kit box from inside of the unit. Assembly kit box is usually putted in the fan section.
- check the completeness of all parts (by type, size and quantity), according to attached technical data sheet or list
- remove all other boxes with parts from the unit (if delivered) and put them on a dry and safe place. Sections with additional boxes and parts are additionally labeled on unit access side
- remove all auxiliary brackets (if any) used to protect unit components during transport
- pull down the unit from the wooden pallet or wooden supports used during transport
- remove all other suspension components used for transport and unloading
- mount dampers, flexible connections and hoods (if dismantled from the unit)
- place the unit sections in the location envisaged, following the instructions relating to the position of individual sections within the entire unit (applies to units supplied in several delivery sections) according to the assembly plan affixed to each section

Assemble the unit delivery sections using the assembly kit.

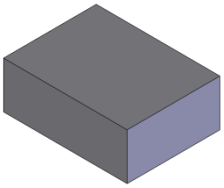
ASSEMBLY KIT

Basic assembly kit (may vary regarding the unit configuration):

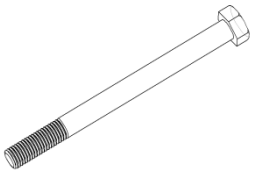
A – SEALING STRIP



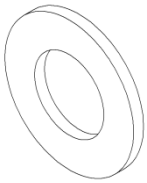
B – RUBBER PADS



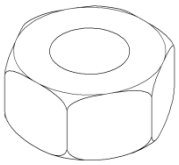
C – SCREW



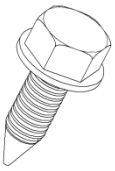
D – WASHER



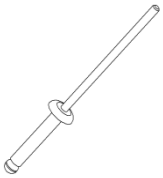
E – NUT



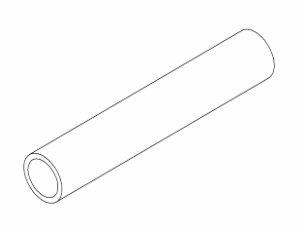
F – THREADED SCREW



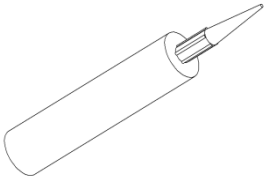
I–BLIND BOLT



J-PIPE INSERT



K – SEALING KIT



The unit sections are assembled together in several steps:

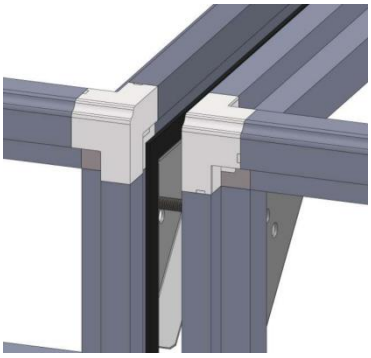
1. Applying sealing strip

If a unit is supplied in more than one delivery section, one side of all joints of unit sections (A) must be covered with 6 mm thick sealing strip.

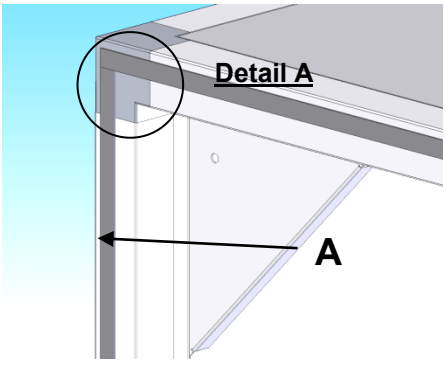
In case the 3 mm thick sealing strip is delivered, it is necessary to apply both sides (delivery sections) with one strip.

Strip should be applied on whole cross section on aluminium profile, as close as possible to outer/inner side of profile or in visible strip groove.

Models 50TH and THOR TB

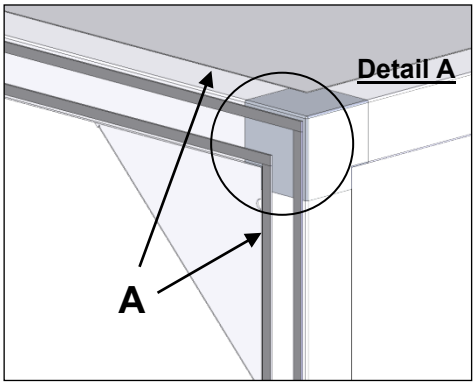


Model 15



Other models

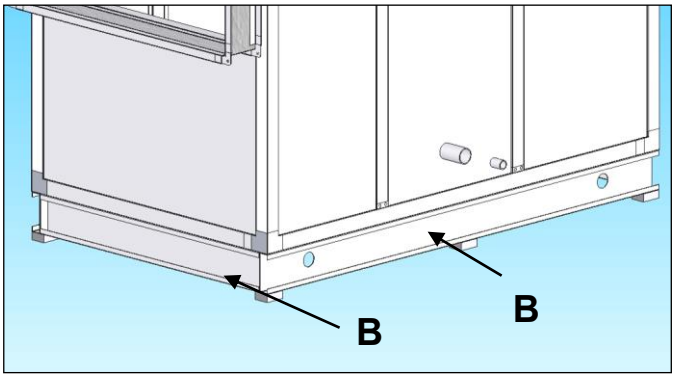
Put two strips, one closer to outside, and the other one closer to inner side of aluminium profile.



Sealing strips must join closely, without overlapping (**Detail A**).

2. Unit positioning, suspending and leveling

UNITS WITH BASEFRAME



Each unit section is to be placed in a corresponding location in the engine-room (according to the unit assembly plan) or any other location as may be specified by the design.

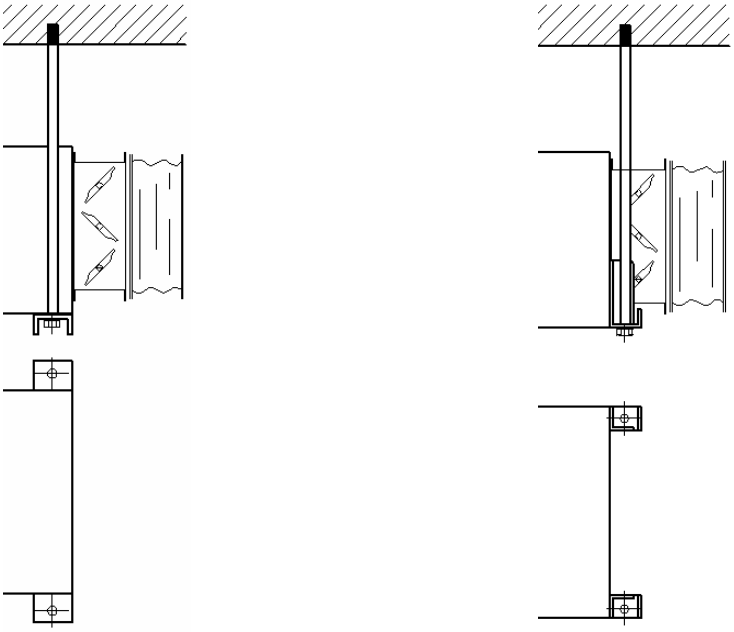
Put rubber pad (B) under the baseframe – for section less than 2 meters long - on each section corner, and for sections longer than 2 meters on each section corners and one in the middle.

After rubber pads have been under laid, all sections must be leveled.

OUTDOOR INSTALLATION

All openings of the unit (for e.g. to ventilation ducts, electrical terminal boxes etc.) must be closed or protected from atmospheric conditions, to avoid moisture in the device. Do not install inlet or outlet air connections in the wind direction. Plan to install the baseframe with height corresponding to maximum snow height in winter time. Connect the drain connections properly.

UNITS WITH ROOF SUSPENSION



a) suspending by profiles *b) suspending by supports*

3. Assembly of delivery sections

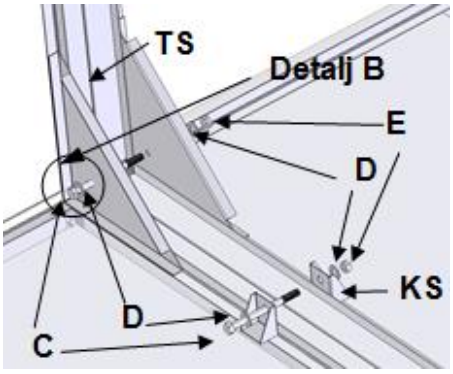
First, put together delivery sections and position the connecting holders (TS) and afterwards on connecting corners (KS).

When assembling sections, if the screw is too long, put additional nut on screw head side (Detail B).

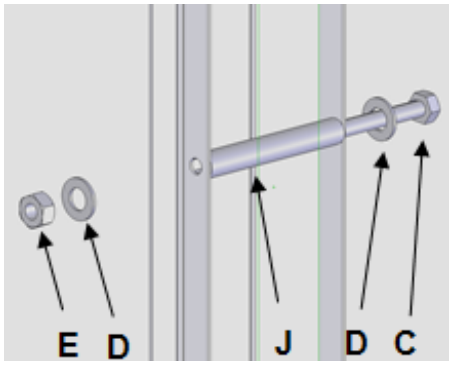
Two or three screw joints on each section should be done with star washer (not in scope of delivery)

After connecting the sections, all sections should be inter-connected with grounding tape (pre-mounted on each section's base frame).

CORNERS



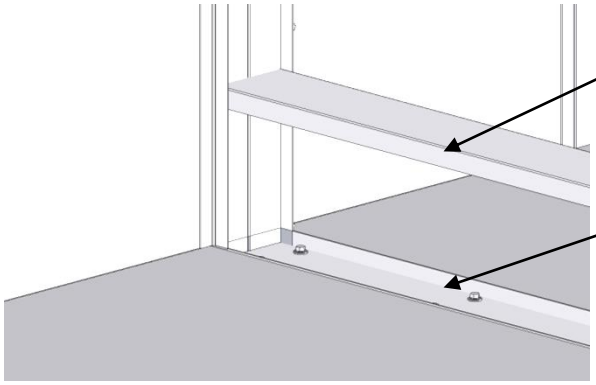
PIPE INSERT



OUTDOOR UNIT

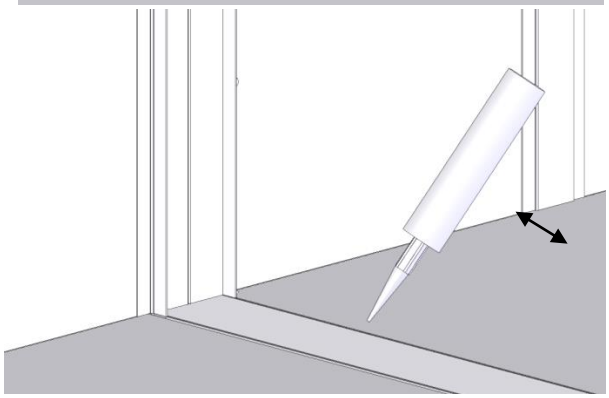
After connecting of outdoor unit delivery sections, seal the outer gap of each joint with sealing kit (K).

FLOOR JOINTS (for hygienic versions)



❶Put sealing strip

❷Insert protective covers



❸Fill the outer gap between protective covers and aluminium profiles with sealing kit (K)

All section joints after assembly should be sealed with silicon free sealing kit.

SIDE-BY-SIDE AND VERTICAL UNITS

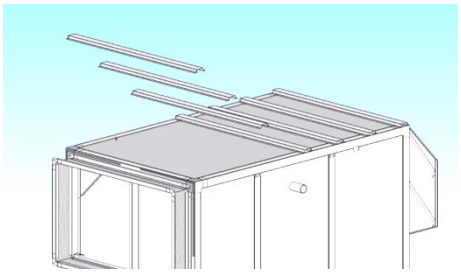
Side-by-side and vertical units should be connected with 6,3x90 mm and 6,3x50 mm screws (placed in assembly kit box) through prepared holes on section profiles.

4. Grounding

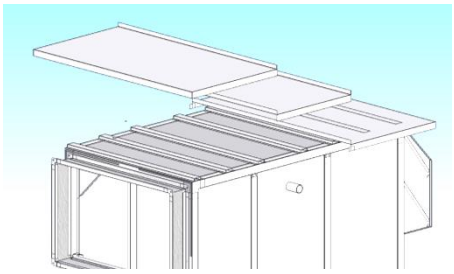
To avoid static electricity transition through the unit, all electrically non-conducting materials must be overridden with equipotential bond for e.g. separate base frame, flexible canvas, rubber insulators under fans etc.

All metal parts of the unit must be connected with equipotential bonds. Unit must be grounded. Find the grounding tape on base frame edge (marked with label). All grounding tape connections must be secured against self-unscrewing.

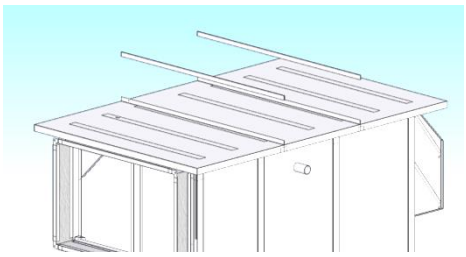
5. Roof assembly (on outdoor units)



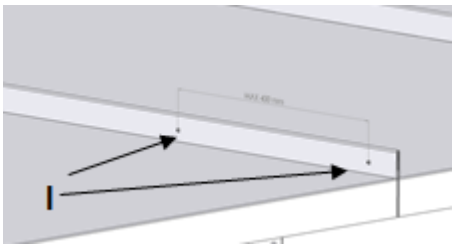
❶ Assemble omega profiles of the roof according to attached drawings. Fix the omega profiles with bind bolts (I) on approx. distance of 400 mm



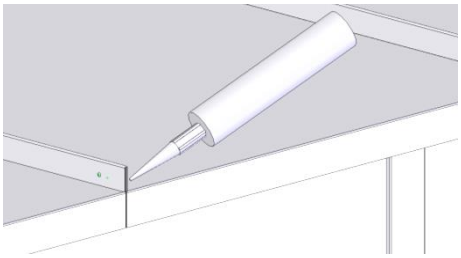
❷ Assemble roof parts according to attached drawing, fix together with blind bolts (I).



❸ Joint of roof plates should be done with protective connecting covers. Covers should be putted on roof plat joints. Make holes on approx. distance of 400mm



❹ Fix the connecting profiles with blind bolts (I).



❺ Put a sealing kit (K) on head surface of joints.

❻ Clean the roof plates and joints from metal chips to avoid corrosion.

2 INSTALLATION

Before installation, check the scope of parts included in delivery from the Manufacturer and presence of all other necessary parts for installation (supplied by the installation company) which are necessary for connection to ventilation duct system.

NOTICE Assembly instructions and component connecting schemas (if delivered separately by the manufacturer) are part of assembly kit

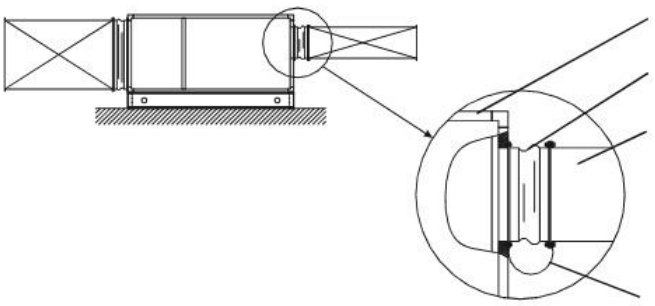
Components usually delivered by the manufacturer (if party of scope of supply):

- humidifiers
- motors
- frequency converters
- rotary heat exchangers
- high-efficiency recuperators
- compressors
- unit with burners, burner engines
- UV lamps, speed controls and similar small electrical devices

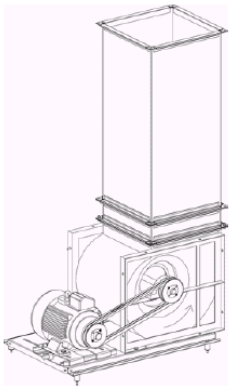
2.1 CONNECTING THE UNIT TO VENTILATION DUCTS

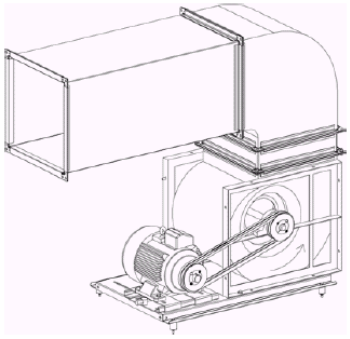
In order to avoid vibration transmission the unit is connected to the air ductwork by means of flexible canvas (integral part of the unit). The flanges of flexible canvas and the air duct should be connected at angles by bolts, but in case of larger duct dimensions, additional clamps are to be used (connecting material not included in the scope of supply).

The air ducts connected to the unit must be fixed on special supports or suspensions. Flexible canvas should be properly stretched to approx. 110 mm (see illustration). The flexible canvas is factory pre-connected with grounding tape.



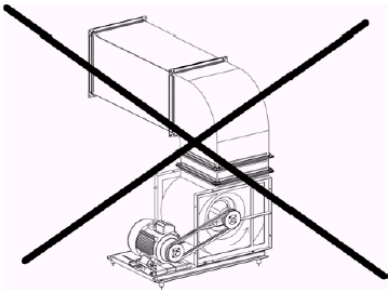
Please connect a straight air duct or appropriate fitting at least 2 m long to the discharge connection. If this is not possible, the air duct elbow direction should follow the fan rotation direction (see illustration).

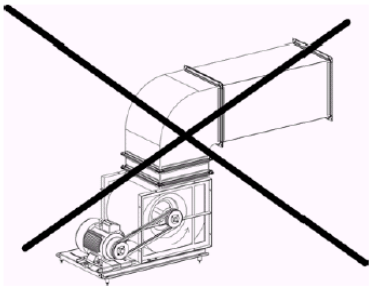




CORRECTLY

INCORRECTLY

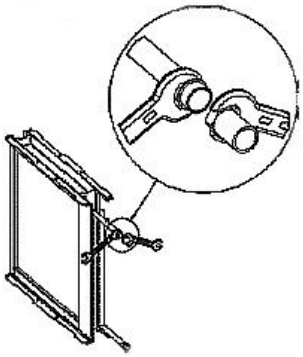




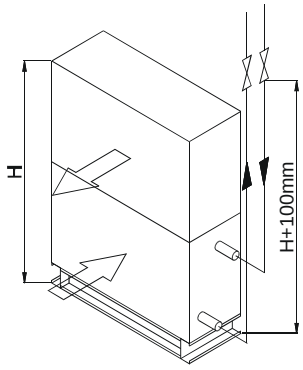
2.2 CONNECTING COILS

Coils (heaters, coolers) should be connected to the hot/cold medium installation in such a way to prevent the transmission of the piping and fittings weight and deformation caused by thermal expansion during heating/cooling to the heat exchanger. Joints should be dismountable (screwed pipe fittings or flanges) and the pipes with thermal insulation and fittings are to be arranged to provide space for accessing filters, fans and other components and facilitate the pulling out of exchangers for cleaning or replacement without emptying the entire system. When tightening a joint (screwed pipe fitting) the connection pipe must be additionally held by an adequate wrench or pliers (see illustration A).

The coil headers are equipped with air release and drain cocks. The valves for connecting coil inlet and outlet should be installed above the unit (min. 100 mm), so the coil could be disconnected and pulled-out for cleaning or replacement (see illustration B)



A)



B)

In order to ensure a proper operation of heat exchanger, the following steps are to be taken:

a) Behind each hot water battery (looking in the direction of airflow through the exchanger) a freeze protection thermostat should be mounted and connected to the automatic control system (the thermostat is supplied as a part of the automatic control, if in scope of supply of the manufacturer).
b) The heat exchanger system of the run around system should be filled with a water-ethylene-glycol mixture or a similar medium of an appropriate concentration depending on the lowest fresh air temperature.
c) Connecting the coils for freezing protection could be done by using 3-way valve, which enables the mixture of supply and return flows. Connection should be done by qualified personal or by consulting with the manufacturer.

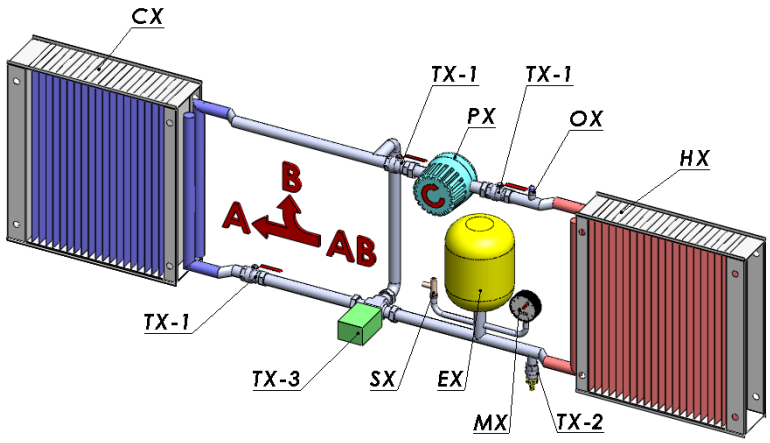
Air coolers are placed in a condensate tray. Condensate removal from the tray is carried out by a nipple on the front or bottom panel of the cooler section to which a properly dimensioned siphon should be connected.

Water inlet and outlet connections should be mounted to the heat exchangers in such a way to ensure heating/cooling medium COUNTER-FLOW in relation to the airflow direction. (A parallel flow heat exchanger has a reduced capacity in relation to the counter-flow heat exchanger – by approx. 10% on heaters and approx. 20% on coolers!)

NOTICE Heat exchangers containing refrigerants should be connected by a qualified personal in accordance with the rules of refrigeration technology.

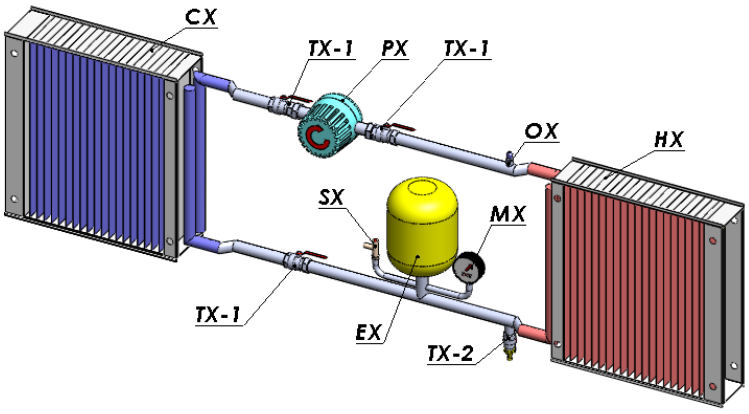
2.3 CONNECTING RUN-AROUND COILS

A proper method of connecting run-around coils to water/glycol heating/cooling installation is showed in the following illustrations:



CONNECTION OF RUN-AROUND COIL – type 1

HX	Heater
CX	Cooler
TX-1	Shut-off valve
TX-2	Drain / Fill-in
TX-3	3-way valve
SX	Safety valve
OX	Release pipe
PX	Circulating pump
EX	Expansion vessel
MX	Manometer



CONNECTION OF RUN-AROUND COIL – type 2

HX	Heater
CX	Cooler
TX-1	Shut-off valve
TX-2	Drain / Fill-in
SX	Safety valve
OX	Release pipe
PX	Circulating pump
EX	Expansion vessel
MX	Manometer

NOTICE

Connection of fittings might differ depending of application, customers request or designer idea. Please check the actual layout and connection schema in project documentation, customers request or application type. Connection schema of circulating pump is placed on the pump motor cover.

2.4 HYDRAULIC MODULE

NOTICE Before installation check the scope of parts included in delivery and check other parts for installation (delivered by the installer) needed for full functional connection of hydraulic module to the unit and ventilation system.

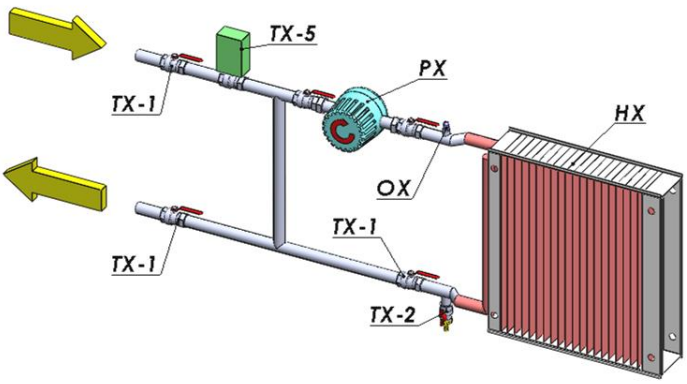
NOTICE Connection of fittings might differ depending of application, customers request or designer idea. Please check the actual layout and connection schema in project documentation, customers request or application type.

Hydraulic module consists of circulating pump, fittings, pipes and other components of hydraulic circle circulating the media through the coil(s). It could be factory mounted or loose (delivered in parts).

Electric motor of circulating pump is delivered with nominal voltage of 1 x 230 V or 3 x 400 V / 50 Hz. Connection should be done according the data and instructions on pump nameplate and attached instructions of pump manufacturer (check under pump cover). All electrical parts must be properly grounded.

Check and adjust the motor and pump rotation, which should correspond with the label on pump casing. If not correct, switch the electrical connections on terminal box.

Connection of hydraulic module components is done according to one of the following typical schemas or according to special schema (if attached by the Manufacturer with technical data of the unit):



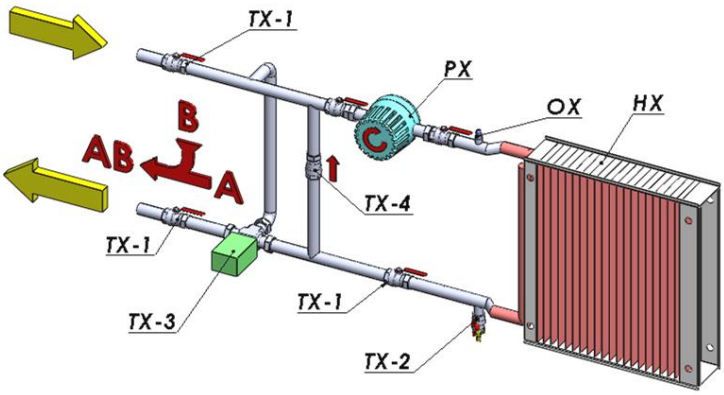
HEATER – type 1

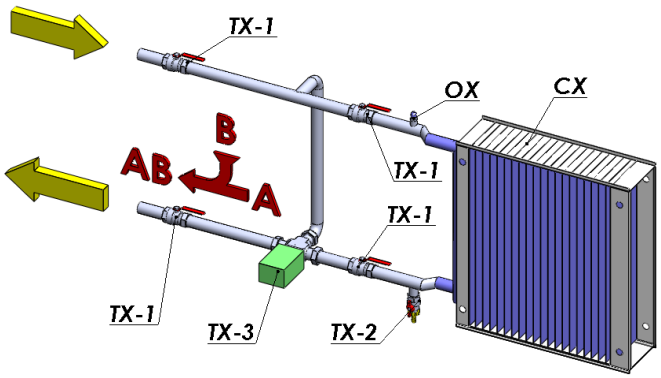
H	Heater
TX-1	2-way valve
TX-2	Drain / Fill-in
TX-5	Valve actuator
OX	Release pipe
PX	Circulating pump

HEATER – type 2

HEATER / COOLER - type 1

HX	Heater (Heater/Cooler)
TX-1	2-way valve
TX-2	Drain / Fill-in
TX-3	3-way valve
TX-4	Non-return valve
OX	Release pipe
PX	Circulating pump



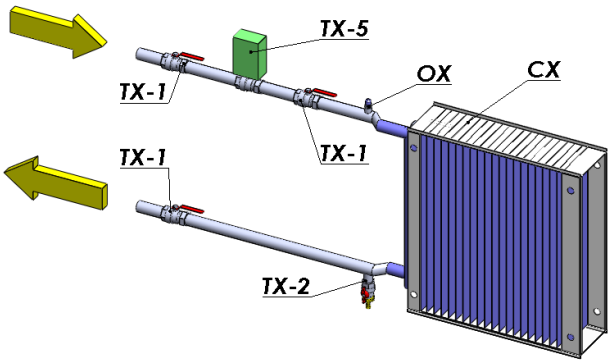


COOLER – type 1

CX	Cooler
TX-1	2-way valve
TX-2	Drain / Fill-in
TX-3	3-way valve
OX	Release pipe

COOLER - type 2

CX	Cooler
TX-1	2-way valve
TX-2	Drain / Fill-in
TX-5	Valve actuator
OX	Release pipe



Before filling the system, pressure test of piping should be done. Use the test pressure of 50 % higher than nominal pressure stated on naming plate or attached technical data. Pressure drop should be done according to EN 13480-5 or according to protocol (available by the Manufacturer on request).

After installation, system must be flushed (for dirt removal) and filled with appropriate media with anti-frost liquid, in proper concentration, according to data on nameplate or attached technical data. Water quality should be according to guideline

VDI 2035. During fill-in, check the connections for leaks. Tighten the screws and connections, if necessary.

NOTICE During fill-in of coils with media, be aware of requested media specification on nameplate or attached technical data.

2.4.1 ALLOWABLE PRESSURES

Minimum and maximum allowed pressures of media used (in absolute values) are indicated in the following table:

Exchanger type	Minimum pressure bar	Maximum pressure bar
Water/Glycol	1,5	21
Steam	0,5	42
Freon evaporator /condenser	depending on evaporating/condensing temperature	42
Coil heat exchangers (heater/cooler)	1,5	21

2.4.2 WATER QUALITY

Recommendations on water quality for heat exchangers that operate using low pressure hot water (LPHW) and chilled water:

- A good water quality – e.g. salt and lime scale-free drinking water – increases the lifetime and efficiency of the heat exchanger.
- Check the guide values shown in the table annually to prevent damage to the hydraulic system and its components.
- Use the water with quality of boiler heating system (according to local rules)
- If necessary inhibitors must be added (against lime scale, corrosion, germs etc.)
-

Description	Symbol	Values	Expected effect in case of deviation	
Calcium and magnesium	hardness (Ca / Mg	4-8,5 °D	>8,5	Fouling
Hydrogen ion concentration	pH	7.5-9	<7 >9	Fouling Corrosion
Chlorine ions	Cl^-	<50 ppm		Corrosion
Iron ions	Fe^{3+}	<0.5 ppm		Corrosion
Magnesium ions	Mg^{2+}	0.05 ppm		Corrosion
Oxygen	O_2	<0.1 ppm		Corrosion
Carbon dioxide	CO_2	<10 ppm		Corrosion
Hydrogen sulphate	H_2S	<50 ppb		Corrosion
Ammonia	NH_3	<0.5 ppm		Corrosion
Chlorine	Cl_2	<0.5 ppm		Corrosion
Ratio of carbons / sulphates	HCO_3^{2-}/SO_4^{2-}	>1	<1	Corrosion

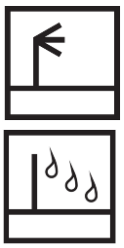
1/1.78 °dH = 1 °TH with 1 °TH = 10 g $CaCO^3/m^3$
ppm – parts per million (mg/l)
ppb – parts per billion (µg/l)

NOTICE	This guide values represents only the basic information about water quality and do not represent any basis for warranty of proper work or warranty claims!

NOTICE	During fill-in of coils with media, be aware of requested media specification on nameplate or attached technical data.

2.5 CONNECTING AIR WASHERS AND HONEYCOMB HUMIDIFYERS

NOTICE	Feed water of honeycomb humidifier should not be necessary softened, but it is necessary to clean the honeycomb from lime scale or germ particles.



Air washer and honeycomb humidifiers are fitted with a water container (tank), a pump, piping's, a nozzles / honeycomb, including connections for feed water inlets through a float valve, liquid overflow through a siphon and a water drain. Freed water should be done with shut-off valves and water filters (delivered by the customer or installer).
Before commissioning, quality of feed and recirculating water should be checked by water analysis (at local water quality institute).
Total water hardness must be lower than 7 °dH or within the limits proscribed with Manufacturers specifications (attached to the unit or provided by the Manufacturer on request).
Microbiological quality of feed water of spay humidifiers should be within the standard limits of boiler heating system (according to local rules).

Feed water temperature must be from 4 - 80 °C

Operating water pressure of feed water must be within the limits (see chapter 2.5.1).

Recommended values for the quality of water circulating in the air washer in accordance with VDI 3803:

Description	Unit	Normal climatic requirements	IT rooms	Sterile rooms and cleanrooms
Electrical conductivity (at 20 ^{o}C)	µS / cm	<1.000 *	<300	<120 **
Carbonate hardness	^{o}dH	<4 i <20 ***	<4 i <20 **	-
Chloride	g/m^3	<180	-	-
Sulphate	g/m^3	<290	-	-
Germ count	(JK/ml)	<1000	<100	<10
pH value		7 - 8.5	7 - 8 5	7 - 8.5
Legionella bacteria	(JK/ml)	<1	<1	<1
Thickening ratio	-	2 do 4	2 do 6 ****	2 do 8 ****

JK = number of colonies 1/1.78 ^{o}dH = 1 ^{o}TH with 1 ^{o}TH = 10 g $CaCO_3$/m^3

*) Lime scale removal might be necessary or partial water softening needed (for e.g. adding the polyphosphates, ion exchange, carbons removal etc.);
If sodden with 95% r.H. electrical conductivity must be limited to 800 µS / cm
**) Full water softening needed
***) With hardness stabilization
****) Lower limits without additional measures for sterilization;
Higher values for additional measures

Calculation of saturation with results of fresh water and recommended guide values for circulating water quality (see table):

Saturation ratio = Recommended value in circulating water / Values for drinking water

Saturation ratio is calculating for electrical conductivity, hardness, chlorine concentration and sulphates. Lowest limit of calculated ratio should be near the recommended values (see table). If values are less than 2, additional measures for water purifying should be done. Contact the company for water treatment.

Setting the values for monitoring hygienic correctness of water might be set by the lowest saturation ration:

Limit of elec. conductivity = lowest saturation ratio x elec. conductivity of drinking water.
Interval of cleaning = tank capacity x (Saturation ratio -1) / evaporated water quantity.

2.5.1 ALLOWABLE FEED WATER PRESSURES

Allowable minimal and maximal feed water pressures (absolute) are shown in the table:

Humidifier type	Min. pressure / bar	Max. pressure / bar
Electric steam generator	1,5	3
Steam with steam register	2	2,5
Spray humidifier (Air washer)	1,1	4,5
Honeycomb humidifier, with circulating water	5	10
Honeycomb humidifier, with direct evaporating of water on cell pads	1,5	10

NOTICE This guide values represents only the basic information about water quality and do not represent any basis for warranty of proper work or warranty claims!

NOTICE During fill-in of coils with media, be aware of requested media specification on nameplate or attached technical data.

NOTICE Before installation check the scope of parts included in delivery and check other parts for installation (delivered by the installer) needed for full functional connection of humidifier to the unit and ventilation.
Connection schema of circulating pump is on pump cover.

2.6 CONNECTING STEAM HUMIDIFIERS

Steam humidifier is supplied in two designs; like electric steam generator or steam register.

Quality of feed water should be within the standard limits of boiler heating system (according to local rules) or within the limits proscribed with additional instructions of humidifier manufacturer (delivered with the unit or provided by the Manufacturer on request).

Recommendation for water quality of components using low pressure hot or cold water:

- Good water quality without salt or drinking water (without lime scale) extends the lifetime of exchangers and effects on good heat transfer efficiency.
- Regularly check the guide values of water quality for preventing damage of hydraulic circuit and its components
- If necessary inhibitors must be added (against lime scale, corrosion, germs etc.)

ELECTRIC STEAM GENERATOR

Vapor lances of a steam power humidifier are mounted in the casing interior and connected by steam supply pipes to the steam power generator placed in the engine-room, independently of the unit. Condensate drain from a vapor lance shall not be connected directly to the sewage pipe, but only through a free discharge point. The steam power generator must be installed by a person qualified for connecting electrical installations

Feed water for steam generator should not be corrosive, blow off odors and should not contain too much lime scale, to avoid deposits.

Water, either from public network or softening facility, must have the following characteristics:

Recommended guide values of water for feeding the steam generator:

				Unprotected heating components		Heating components protected with anti-adhesion layer	
				min.	**max.**	**min.**	**max.**
Specific conductivity in 20 ° C / 68 ° TH	□20	-	µS/cm	20	1500	1	1500
Total dispersed substances	TDS	-	mg/l	(1)	(1)	(1)	(1)
Fixed residues on 180 ° C / 356 ° TH	R180	-	mg/l	(1)	(1)	(1)	(1)
Hydrogen activity	6.1.1 pH	-		6,5	8	6	8.5
Total hardness	TH	-	mg/lCaCO3	0(2)	400	0	400
Temporary hardness		-	mg/lCaCO3	0(3)	30	0	300
Chloride		-	ppmCl	=	20	=	50(4)
Iron + Manganese		-	mg/lFe+Mn	=	0.2	=	0.2
Silicon dioxide		-	mg/lSiO2	=	20	=	20
Remaining chlorine		-	mg/lCl-	=	0.2	=	0.2
Calcium sulfate		-	mg/lCaSO4	=	100	=	100
Metal dirt		-	mg/l	0	0	0	0
Solvents, thinners, cleansers, grease		-	mg/l	0	0	0	0

TH – French degree of hardness, 1TH = 0,56029 °dH

(1) Value depends of specific conductivity; in general: TDS σ 0,93 * σ R, 20° C, R180 σ 0,65 * σ R, 20° C;

(2) not less than 200% content of chlorine in mg / l Cl-

(3) not less than 300% content of chlorine u mg / l Cl-

(4) Might be necessary to react on drain spot to avoid concentration in water greater than 300 mg / l Cl-.

Keep in mind that water treatment with softener or polyphosphates do not reduce the quantity of melted salts, but might form foam and cause not proper operation or corrosion of heat components.

If softened water is used, it must be tinned with drinking water from pipe in concentration producing the minimal hardness of 5° TH, and parameter b4 (value 1500) should be set to increase the frequency of thinning the drain.

It is NOT recommended:

1. to use well water, industrial water or water from cooling towers, or in general, water possibly contaminated with chemical or microbiological contaminants;
2. addition of disinfection or anti-corrosion compounds into water, due to possible irritation.

It is not a rule between water hardness and conductivity. But, as a markup, water with 40° TH of hardness should have approx. 900-1000 mS / cm electrical conductivity at 20° C.

Manufacturer's recommendation is to connect the condensate drain pipe into a free drain spot (and not return to steam generator).

Steam humidifiers pipes or registers are delivered mounted to the unit (as standard), and other parts and fittings (valves etc.) are delivered loose (placed separately in a box, in steam unit section).

Pipes, fittings and connecting material are not included in delivery of the Manufacturer.

STEAM REGISTER

Steam unit consists of casing, steam register with connectors for steam and condensate and automatic control components, fittings and steam valve (not delivered as standard, delivered upon request).

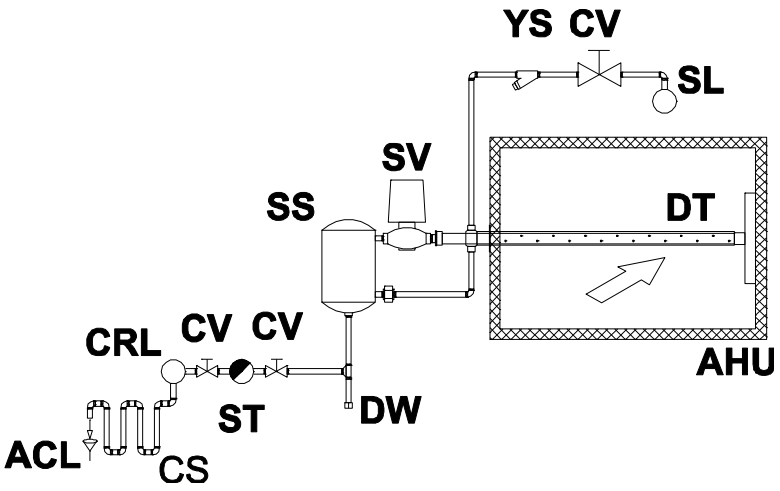
Low pressure steam pipe with steam register is installed on inner side of casing, and with special connection on unit casing and steam valve (delivered by the customer or installer) and connected with low pressure steam system. Allowable absolute steam pressure to 1 bar. In case of higher pressures, it is recommended to install appropriate steam reduction valve for lowering steam pressure.

Typical connecting schemas:

Units with single pipe

Legend:

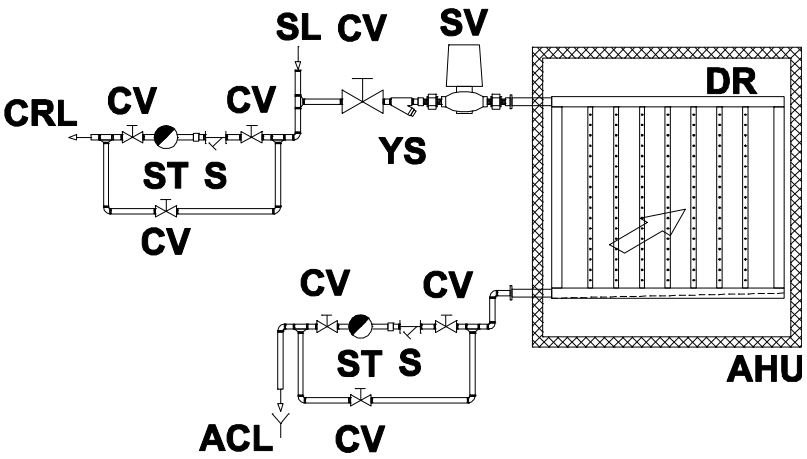
SS steam separator
DT dispersion pipe
SV steam valve
YS Y connector
ST condensate vessel
SL steam feed
ACL free drain spot
CV shut-off valve
DW condensate drain
AHU air handling unit



Units with steam register

Legend:

DR steam register
SV steam valve
S connector
YS Y connector
ST condensate vessel
SL steam feed
ACL free drain spot
CV shut-off valve
CRL condensate return
AHU air handling unit

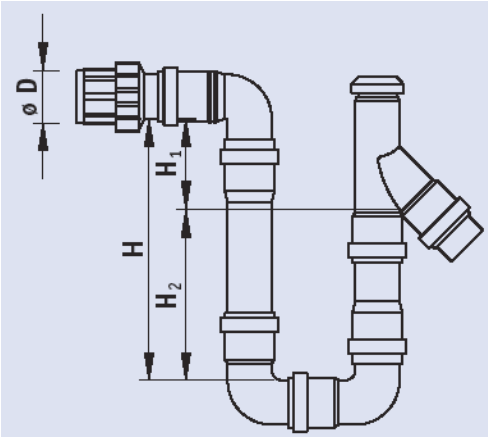


DANGER Water in humidifier could reach the temperature higher that 100°C. Installed pipes for drain must be resistant to high temperatures and enable proper drainage. It is recommended to install pipe slope of at least 5° downwards.

2.7 SIPHON MOUNTING

During the operation of the unit condensate is generated on the air cooler unit, TWIN-COIL and multi-plate recuperator, which is then collected in adequate containers (drain pans). Condensate drainage from the unit is performed by means of a siphon of a corresponding height; depending on overpressure or rather sub atmospheric pressure at the point of connection.

- with overpressure at mounting location:
H1 = 30 mm,
H2 = p + 30 mm
-with under pressure at mounting location:
H1 = p + 30 mm,
H2 = p / 2 + 30 mm
where
p = means medium pressure at the mounting location in [mm VS] (1 mm VS = 10 Pa)



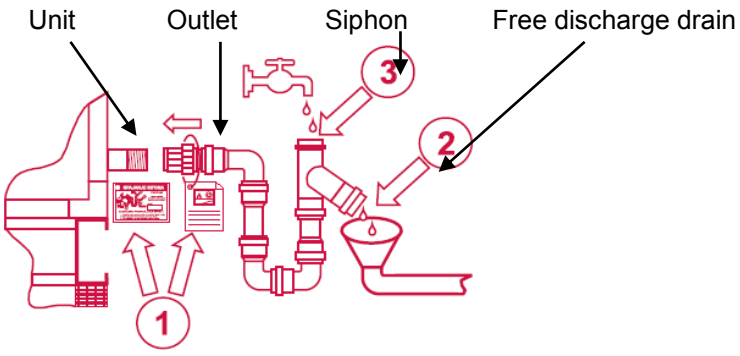
The nominal size ϕD of the siphon is determined according to the following table:

Unit size		ϕ D
KU-P 1 to KU-P 3 KEK-P 1 to KEK-P 3	DN 25	1 "
KU 1 to KU 6 KEK 1 to KEK 6	DN 25	1 "
KU 7 to KU 24 KEK 1 to KEK 17	DN 32	1 ¼ "

The water outlet from the siphon must not be connected directly to the sewage pipe, but rather through a free discharge drain (see the illustration).

IT IS NOT ALLOWED TO CHANGE THE FACTORY PRE-SET SIPHON!!!

1. Connect the siphon according to the label on a siphon and label color.
2. Connect siphon over free drain spot
3. Before commissioning fill the siphon with water



Method of connecting a siphon to the unit and a free discharge drain

Because of different pressure on unit components, it is not allowed to connect multiple drainage on one siphon. Before commissioning, siphons should be filled with water.

Keep in mind: only properly installed siphon guarantee the proper operation!

NOTICE In case that siphon water may be frozen, the siphon must be thermally insulated or rather an adequate siphon heater fitted.

NOTICE Siphons that are delivered ex-factory are labeled and ready for installation. In case of installation of your own siphons, please check the pressured on the place of installation for proper siphon dimensioning.

2.8 UNITS WITH BURNERS

The unit with a burner consists of a casing, a by-pass line with a built-in damper and a gas burner. The heat exchanger is made of steel sheet and consists of a combustion chamber, a coil and a flue gas chamber with a gas exhaust connection.

The gas burner is connected to the combustion chamber inlet on the service side by an adequate flanged joint, and the flue gas chamber with a gas exhaust connection is located on the rear side of the unit.

For units of the indoor design, efficient ventilation of the engine-room and an adequate flue gas exhaust system (flue stack) must be provided. A unit with a burner must be connected to the flue stack in compliance with the requirements for flue stacks. All joints must be air-tight to prevent possible condensate leakage into the environment. When connecting to the flue gas exhaust system it is necessary to consult the chimney-sweeping service and observe all legally prescribed fire-prevention standards.

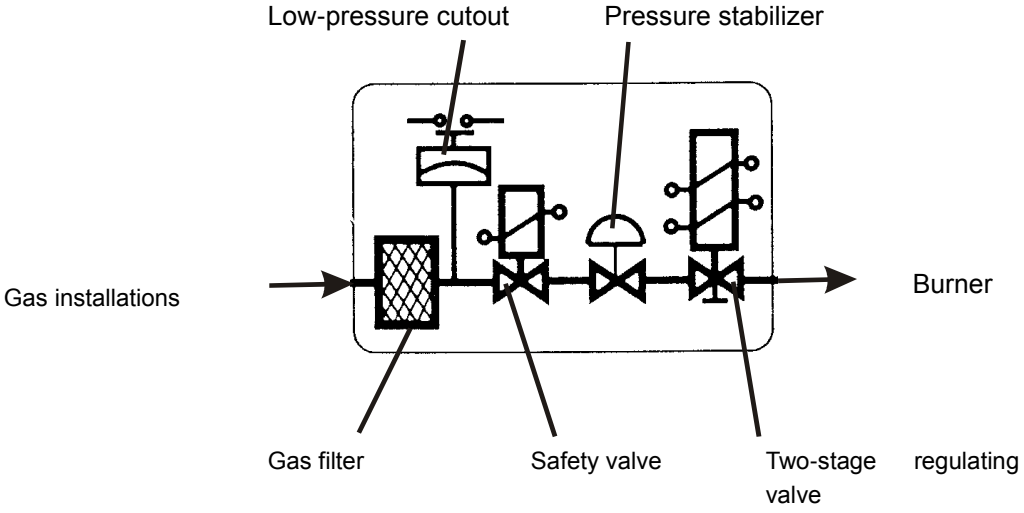
The gas supply to the gas burner must be performed in such a way as to facilitate access and pulling of individual components out of the unit with a burner.

Unit with gas burner is mounted on overpressure part of the unit (supply side), so in case of exchanger damage, mixing of supply air and exhaust gases could be avoided.

Parameters and settings of all parts of burner section should be set according to gas burner manufacturer, delivered together with the burner.

When mounting, starting up, maintaining and servicing the unit it is necessary to follow instructions supplied by the burner manufacturer.

2.8.1 G AS RAMP SCHEMATIC DIAGRAM

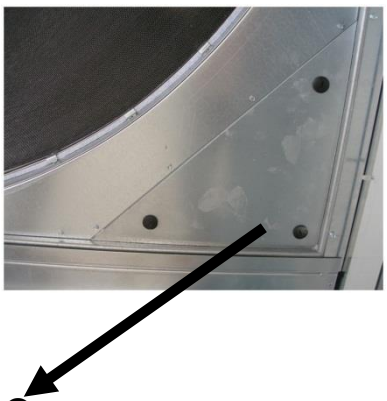


2.9 ROTARY HEAT EXCHANGERS

A rotary heat exchanger is driven by an electronic speed control unit, a rotary heat exchanger motor and a belt transmission. The speed control unit mounted in the heat exchanger casing performs several standard functions that ensure the optimum heat recovery depending on the mode of operation (summer/winter) and motor protection. The system is adjusted to receive standard measuring signals, e.g. 0-10 V or 0-20 mA. The rotary motor is fitted with a connection for one-phase alternate current of 230 V / 50 Hz (for rotary heat exchanger casings of a nominal size of 999 mm) or three-phase alternate current of 400 V / 50 Hz (for rotary heat exchanger casings of a nominal size of 1000 mm and more).

In case the heat exchanger is delivered in parts (dismounted), instructions for connecting the rotary heat exchanger please find with assembly parts.

Access and connection of motors of rotary heat exchanger:



❶ Take off the protection plate, on lower corner of the casing

❷ Read the connection schema and user instructions for motor and controller

❸ Unscrew the 2 connecting screws

❹ Pull out the motor on motor slides out of the casing

❺ Open the connecting box of motor (on upper side of motor) and connect the power supply according to attached schema

NOTICE Connection of motors and controller of rotary heat exchanger should be done according to heat exchanger manufacturer instructions.

2.10 HIGH EFFICIENCY PLATE HEAT EXCHANGERS

Unit consists of two heat packages with highly sensible accumulating mass, flushed alternatively with fresh and exhaust air stream.

Instructions and connecting schemas you can find with assembly parts.

2.11 COMPRESSORS (INTEGRATED COOLING)

WARNING	All work on refrigeration circuit should be done by authorized and qualified personal. During work keep the safety measures and all local regulations, standards and guidelines for handling with refrigerants (for e.g. DIN EN 378, EC directives for refrigerants)

COMPACT UNITS (SINGLE DELIVERY SECTION)

Systems in which refrigerant installation is done in one piece and one delivery section.

Installation is delivered either filled with nitrogen or refrigerant, depending of specifically demands of the project. Type of refrigerant which is inside the installation and design parameters are specified in technical data sheet attached on a compressor. On system start-up in automatic mode pipes are filled with refrigerant or only correction of gas quantity in installation is done to put system into design conditions.

MODULAR (MULTIPLE DELIVERY SECTIONS)

For modular units where refrigerant installation is made of several delivery sections, sections are filled with nitrogen gas. After connecting the unit into one piece, connecting the refrigerant installation should be done. Afterwards, installation should be vacuumed and filled with refrigerant, all according to technical data for refrigerant installation.

Before start-up, installation should be checked for leaks.

In case the refrigerant system is delivered without automatic control components, standard control panel for protection of refrigerant circuit parts is delivered according to Manufacturer scheme.

NOTICE	Terminal box on a compressor unit is used for connecting the compressor motor to power supply. Connecting the motor and compressor controller, piping works should be done according to compressor nameplate. In case section includes several compressors/circuits, connection of each should be done according to attached schema and labels on coil collectors (A, B, C etc.).

WARNING	Functional compressor test should not be done with closed valves, without refrigerant, with installation filled with nitrogen or in vacuum, or installation open to atmosphere. Such test might damage the compressor. In case the compressor is damaged with improper operating conditions, damaged compressor will not be treated as warranty claim and Manufacturer warranty will be void.

NOTICE	For each unit with installed compressor (integrated cooling) the logbook should be kept (according to EC directives and local regulations), according to form – see **APPENDIX C**.

2.12 DAMPERS

Dampers consist of a number of aluminium blades bordered with a rubber seal and mounted into a common aluminium frame. PVC drive gears are placed sidelong within the frame and protected against dust.

The brass shaft for counter-flow movement of damper blades has a square cross-section of 12x12 mm and is about 200 mm long. The shaft is also designed for mounting a crank handle for manual activation of blades or an electric-motor drive. It is also possible to mount a lever for simultaneous activation of blades of two dampers for the purpose of mutual airflow control or closing/opening of dampers.

NOTICE	Please consider thermal insulation or adequate damper fins heater to be fitted in case of frost danger.

3 ELECTRICAL INSTALLATIONS

CAUTION	Each electrical components connection (Motors, damper actuators, electric heater, automatic control components, etc.) should be done by a qualified and well-trained personal in conformity with applicable standards, guidelines (VDE etc.) and local regulation.

WARNING	Wear personal protective cloth (shoes, rubber gloves etc.)

Before starting the connecting procedure it is necessary to check the conformity of the mains voltage, frequency and number of phases with the data specified in the technical data sheet or other manufacturer's documents accompanying the unit. In case of any deviations it is not advisable to carry out the connecting operations. When laying especially long cables (longer than 80 m), the cross-section of used cables must be additionally checked.

Protect electrical connections and penetrations from water (especially outdoor units). Cables must enter in terminal boxes from below or by using water-proof cable glands (protection class IP65) with minimal cable radius.

Check all electrical connections (switches, frequency converter, electric motor, etc.) for proper tightening and if necessary re-tighten all the connections (see DIN 46200).

Ground all electrical components (electric heater, motor, actuators etc.) according to Manufacturer instructions, local regulations and general recommendations for prevention of electromagnetic fields (grounding, length of the cable, cable cover etc.).

Connection schema (electric heater, motors etc.) are shown under the terminal box covers.

Check the equipotential bonds to ensure proper connection and if necessary re-tighten it. Check the grounding tape for proper connection.

Ensure that grounding test and insulator resistance test is acc. to DIN EN 60204 and take all necessary precautions.

Voltage of main supply could deviate max. ± 10% from nominal voltage (from nameplate of unit or component) with maximal phase difference of 3%. If voltage of electrical connections exceeds maximal permissible values, and in case of damage, the Manufacturer warranty is void.

3.1 WIRING

All cable penetrations through panels must be airtight and protected against damage that may be caused by sharp edges. Panel penetrations may be performed by drilling or saw cutting and adequate electrical conduits are to be mounted:

Pg		
Gland size	**Panel penetration diameter**	**Connection cable outer diameter**
Pg 11	28 mm	9 – 11 mm
Pg 13.5	32 mm	12 – 14 mm
Pg 16	35 mm	14 – 16 mm
Pg 21	42 mm	19 – 21 mm
Pg 29	55 mm	26 – 28 mm
Pg 36	70 mm	30 – 32 mm
Pg 42	75 mm	35 – 37 mm
Pg 48	80 mm	34 – 44 mm

M		
Gland size	**Panel penetration diameter**	**Connection cable outer diameter**
M16	16.5 mm	3 – 9 mm
M20	21 mm	9 – 13 mm
M25	25.4 mm	10 – 16 mm
M32	32 mm	14 – 24 mm
M40	42 mm	19 – 28 mm
M50	52 mm	26 – 35 mm
M63	66 mm	36 – 46 mm

NOTICE Depending on protection class, dimensions stated above could be different and are subject to change without notice.

Inside the unit cables are to be laid in the way that provides the shortest possible connection of electric components. They have to be sufficiently far from other moving components of the unit (e.g. belt transmission, fan wheel), adequately suspended (at unit edges, opposite to the service side, on top and side panels) and fastened (clips, lashings).

The wiring must be provided in a sufficient length and must provide access to all components that are to be taken out of the unit for any reason (cleaning, replacement).

3.2 DAMPER ACTUATORS

The selection of an appropriate damper actuator depends on the torque required for damper closing. The value of required damper actuator torque must be equal or higher than required value for damper closing, as indicated in the following table:

Unit size	Torque *
KU-P 1-KU-P 3, KEK-P 1 – KEK-P 3	2 Nm
KU 1 - KU 4 , KEK 1 – KEK 4	4 Nm
KU 5 - KU 7 , KEK 5 – KEK 7	8 Nm
KU 8 - KU 10, KEK 8 – KEK 10	15 Nm
KU 11, KEK 11	18 Nm
KU 12 - KU 15, KEK 12 – KEK 15	30 Nm
KU 16 - KU 17, KEK 16 – KEK 17	2 x 18 Nm
KU 18 - KU 19	4 x 15 Nm
KU 20 - KU 22	2 x 30 Nm
KU 23 - KU 24	3 x 30 Nm

* - Values for dampers across whole unit cross-section (full opening). For smaller damper sizes on smaller openings, proportionally reduce needed torque.

In parallel operation of dampers (dampers connected by lever) using a single electric motor, above values must be multiplied by 2.

3.3 MOTORS

Motors should be connected using the overload and short-circuit protection corresponding to the electric motor rated current. The electric motor is fitted with a burnout protection in a form of three PTC thermistors connected in series and mounted into electric motor windings. Thermistors must be connected to an electronic instrument for measuring the winding temperature.

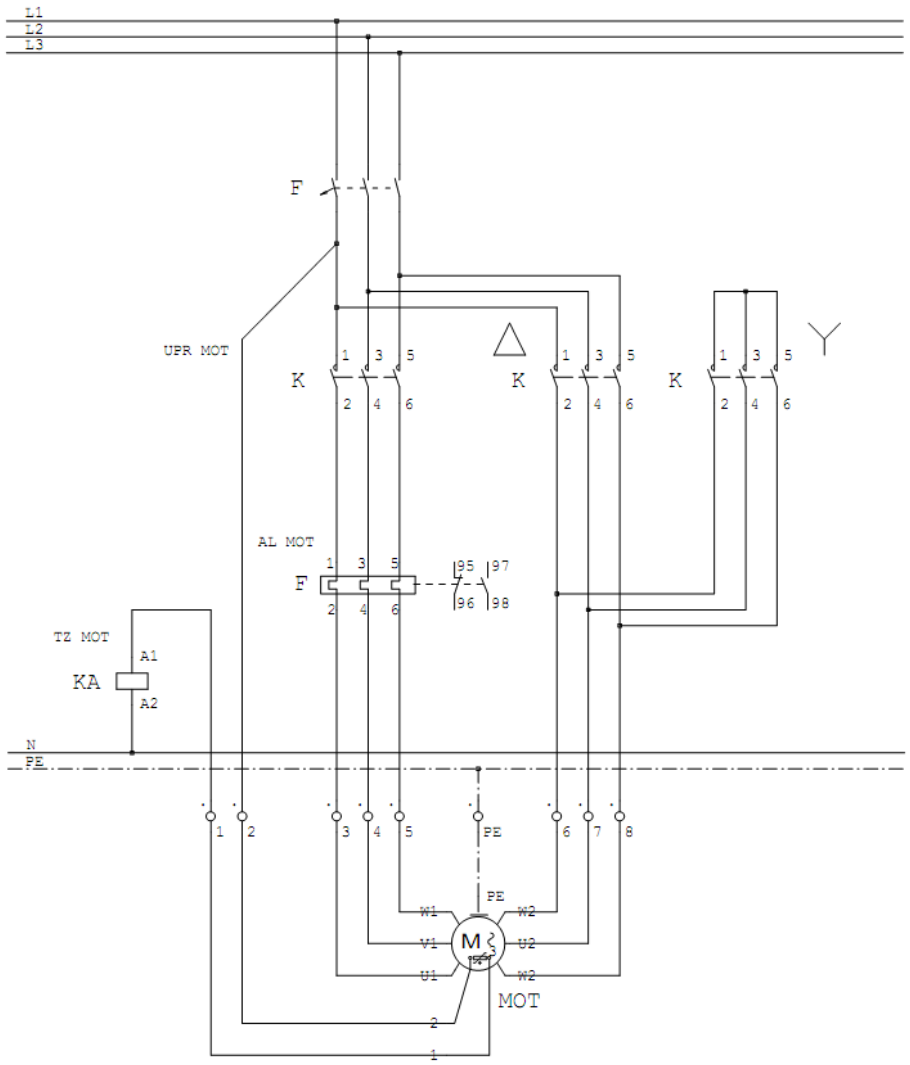
Prior to connecting to the mains it is necessary to make sure that below mentioned diagrams correspond to the data on the motor nameplate and instructions for electric motor installation and maintenance.

WARNING	In order to provide safe repair of the unit, the cutout switch that interrupts the current supply of the fan electric motor during repair must be mounted outside the fan unit. before opening the fan unit service doors (due to failure, repair, stopping, etc.) make sure that current supply of all electrical components is cut off.

NOTICE	Motors of 4 kW rated power are started directly. With rated power of 5.5 kW and higher they are started by means of a star-delta starting connection (see the drawings).

NOTICE	Safety circuit breakers or safety switches do not represent sufficient motor protection. Damage of not fully protected motors is not covered with warranty claims.

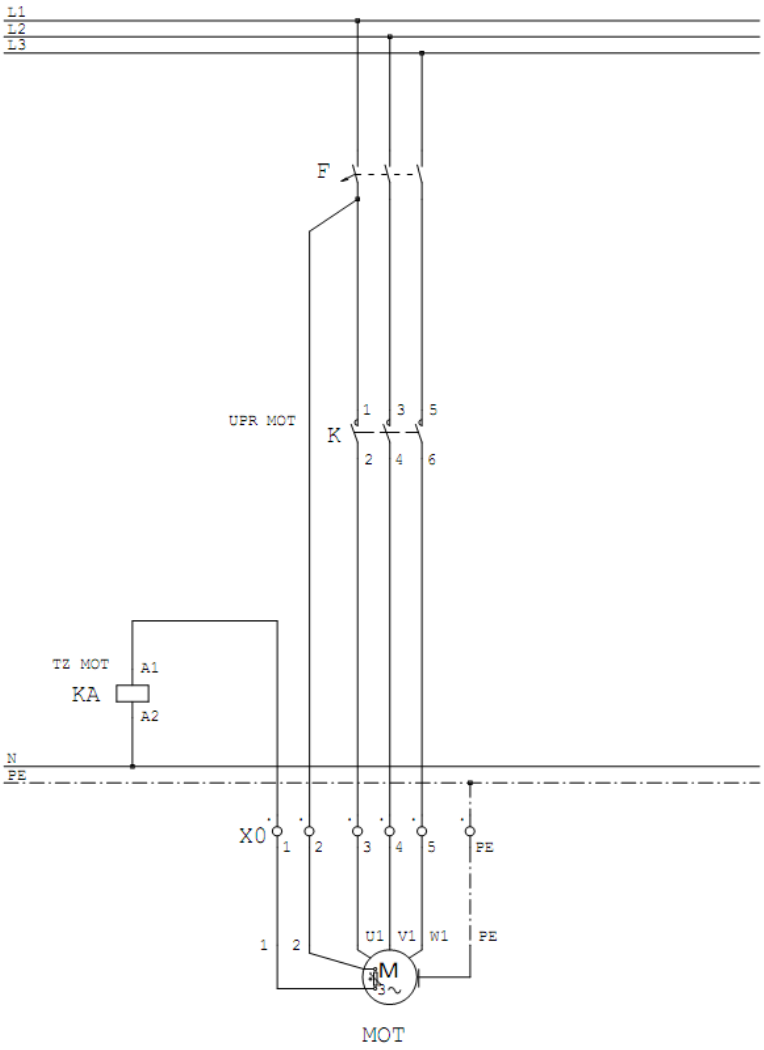
3.3.1 MOTOR START-UP IN Y-D CONNECTION



Key:

F - Fuse
K - Relay
KA – Control relay
MOT - Motor
AL MOT – Motor alarm
TZ MOT – Motor thermal protection
UPR MOT – Motor on/off
X0 – Terminal label

3.3.2 ELECTRIC MOTOR DIRECT STARTING



Key:

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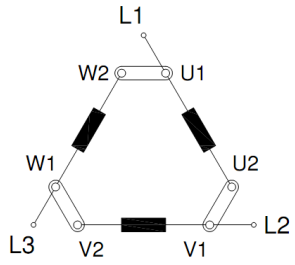
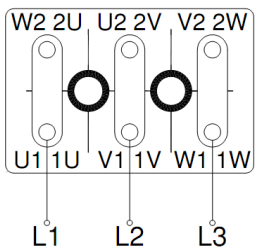
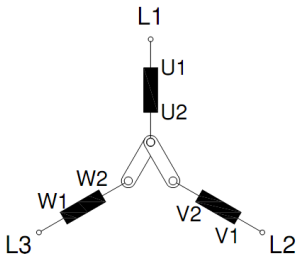
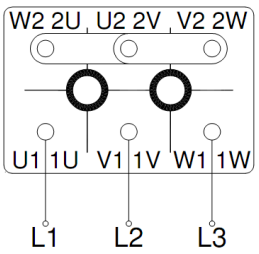
K - Relay
KA – Control relay
MOT - Motor
AL MOT – Motor alarm
TZ MOT – Motor thermal protection
UPR MOT – Motor on/off
X0 – Terminal label





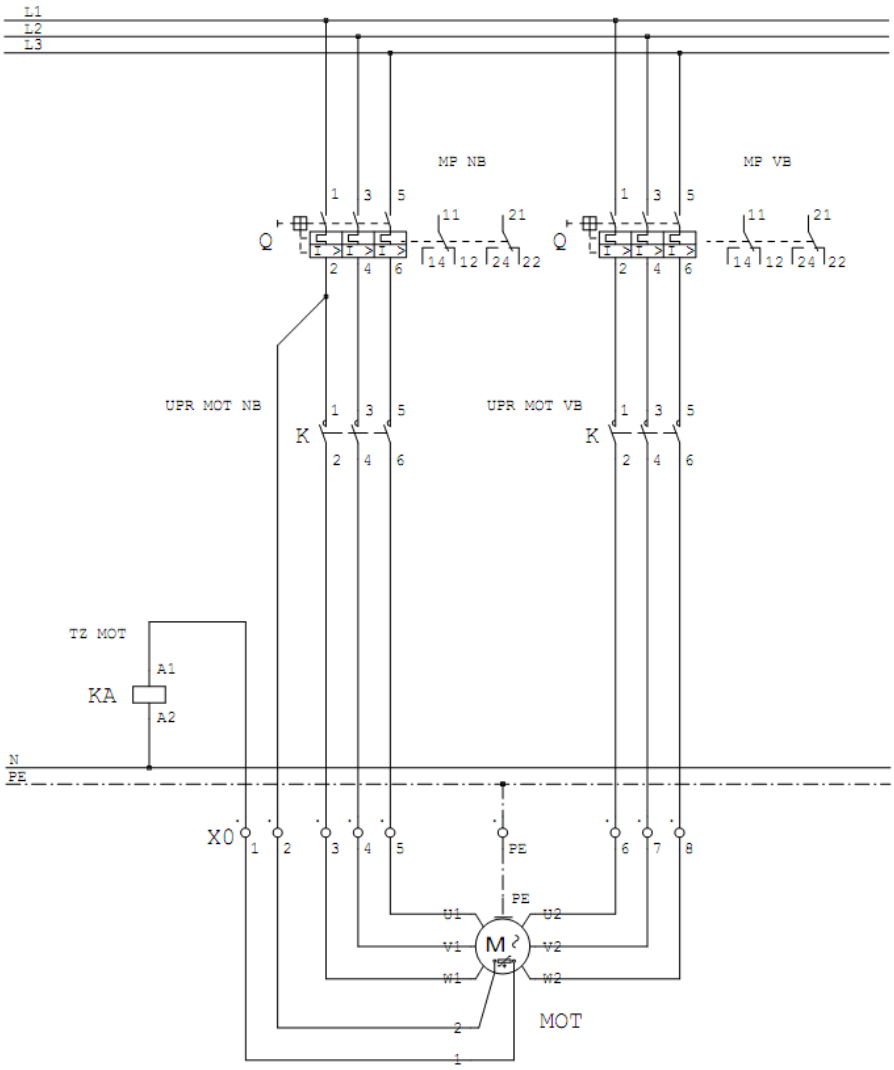
D-CONNECTION
LOW VOLTAGE





Y-CONNECTION
HIGH VOLTAGE

3.3.3 STARTING TWO-SPEED MOTORS WITH TWO SEPARATE WINDINGS



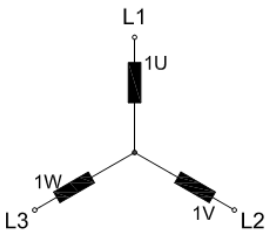
Legend:

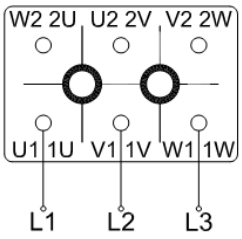
Q – Motor switch
K - Relay
KA - Control relay
MOT - Motor
TZ MOT – Motor thermal protection

MP * - Motor protection switch
UPR MOT * - Motor on/off

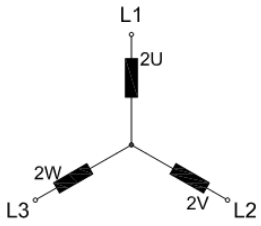
*** NB –** low speed
*** VB –** high speed

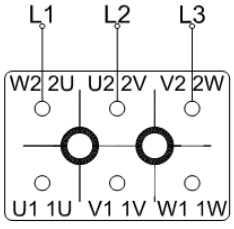
X0 - Terminal label





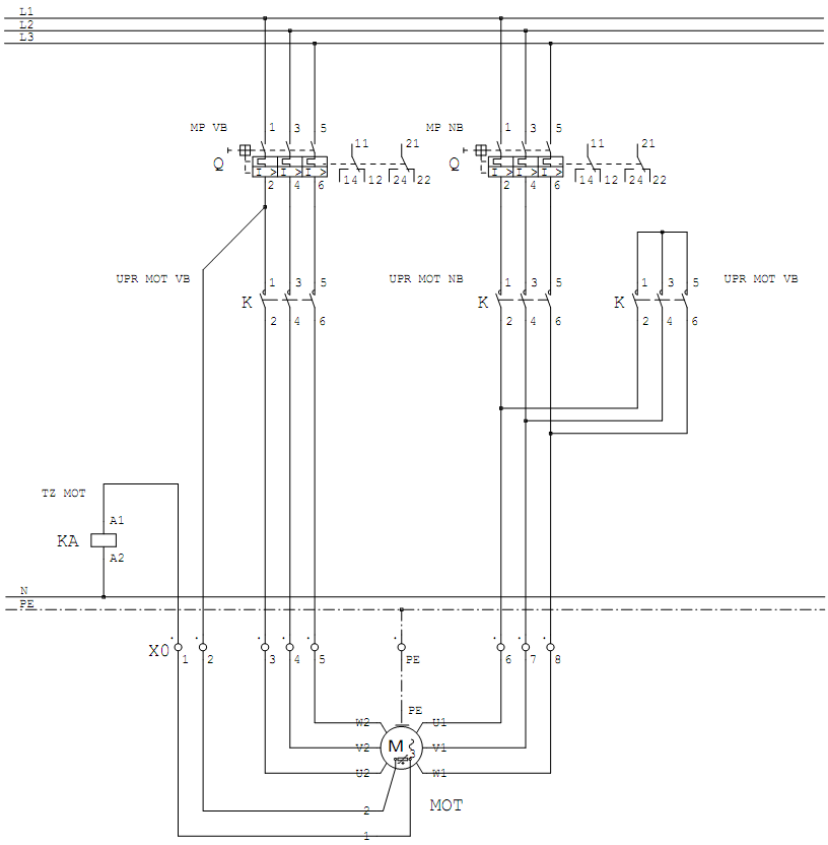
LOW SPEED





HIGH SPEED

3.3.4 STARTING TWO-SPEED MOTORS WITH WINDINGS IN DAHLANDER CONNECTION



Legend:

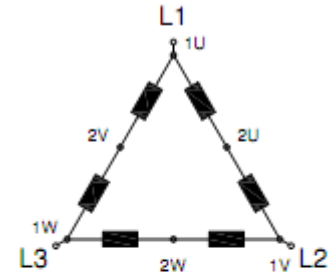
Q – Motor switch
K - Relay
KA - Control relay
MOT - Motor
TZ MOT – Motor thermal protection

MP * - Motor protection switch
UPR MOT * - Motor on/off

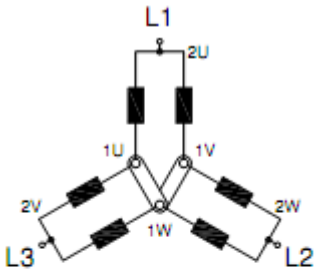
*** NB –** low speed
*** VB –** high speed

X0 - Terminal label

D/YY



D/YY



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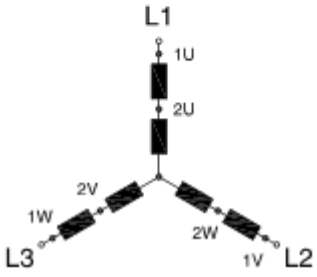
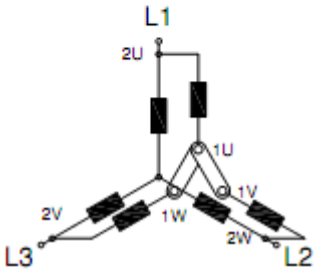
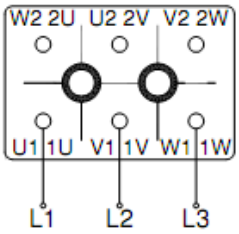
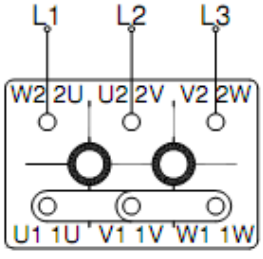


Y/YY





LOW SPEED



HIGHT SPEED

3.4 FREQUENCY CONVERTERS

Installation of frequency converter is done as follows: removing the protection cover and cable glands, setting the cable glands and cover the blind holes, connection to power supply, connection to communication/control network, putting back the protection cover.
Check and provide that at least 100 mm of free space is left in front of the device for ventilation and cooling the device.

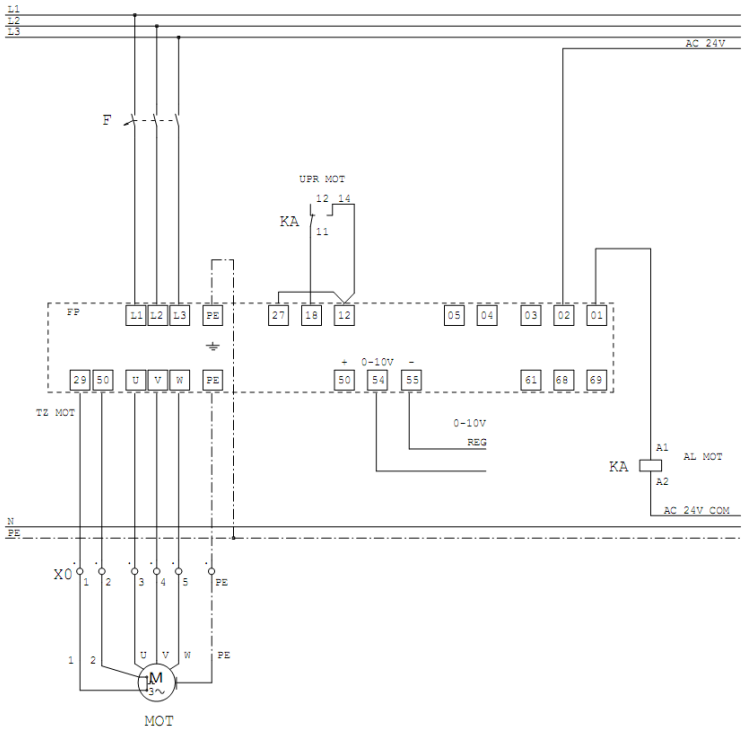
NOTICE Control panel is not delivered as standard with air handling unit (only on customer's request).

3.4.1 SCHEMA FOR CONNECTION OF MOTOR WITH FREQUENCY CONVERTER

Legend:

KA – Control relay
FP – Frequency converter
MOT - Motor
AL MOT – Motor alarm
TZ MOT – Motor thermal protection
UPR MOT – Motor on/off
REG – Speed control signal

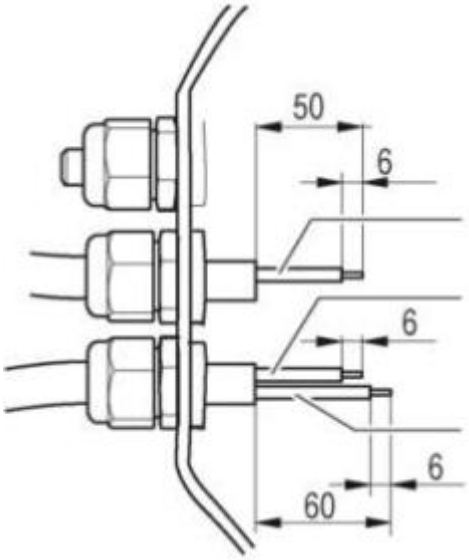
X0 - Terminal label



3.5 PLUG-IN FANS

When connecting the plug-in fans follow the instructions below:

- Ensure proper distance between cables and moving parts. Cable must be properly tighten
- Properly choose and select the cable cross section for motor power supply
- Connect the motor to grounding
- Connect the safety devices (repair switch)
- Check and properly select appropriate fuses for overloading protection REMARK: Safety circuit breakers or safety switches do not represent sufficient motor protection. Install other safety mechanisms (motor thermal protection)
- Measure the inaction current (should be >250 mA)
- Check and install the protection from resident current and set the value to 300 mA
- Properly label the motor cables to terminal box



Control cable

L1, L2, L3

Grounding

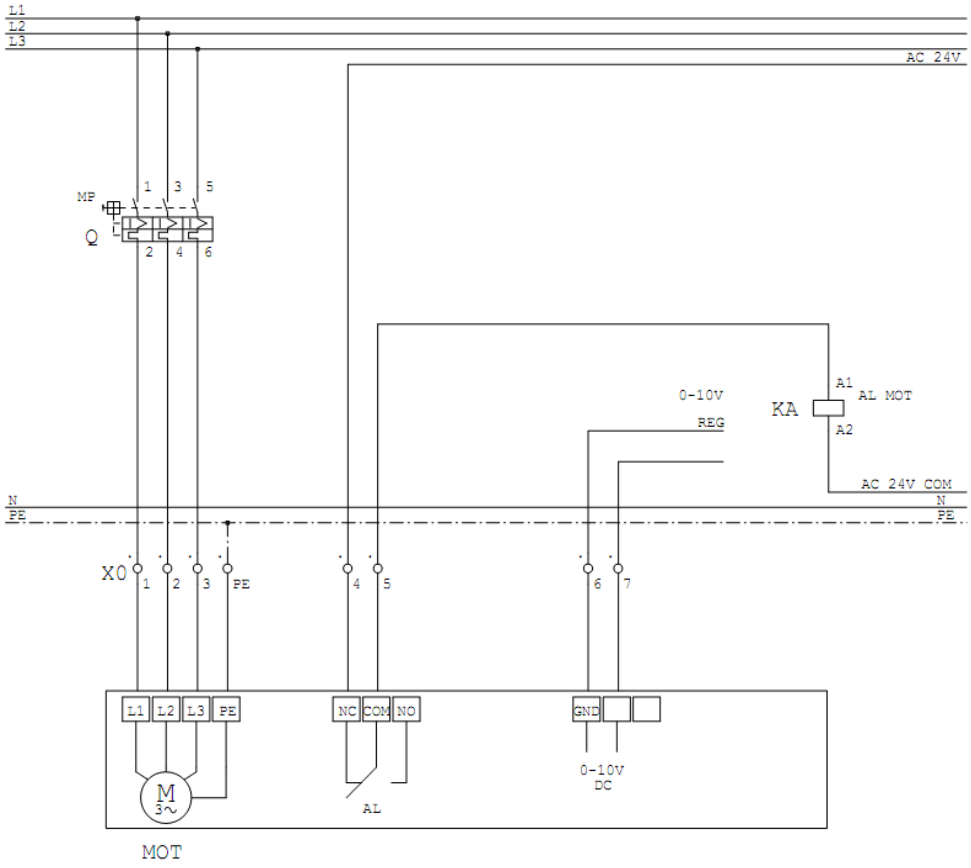
- Close the terminal box and set other safety devices
- Check the factory settings and if necessary, set all other parameters according to design documentation or other documents available

3.5.1 SHEMA FOR CONNECTION OF FANS WITH EC- MOTORS

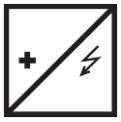
Legend:

Q – Motor switch
KA – Control relay
MOT - Motor
AL MOT – Motor alarm
MP – Motor protection switch
REG – Speed control signal

X0 – Terminal label



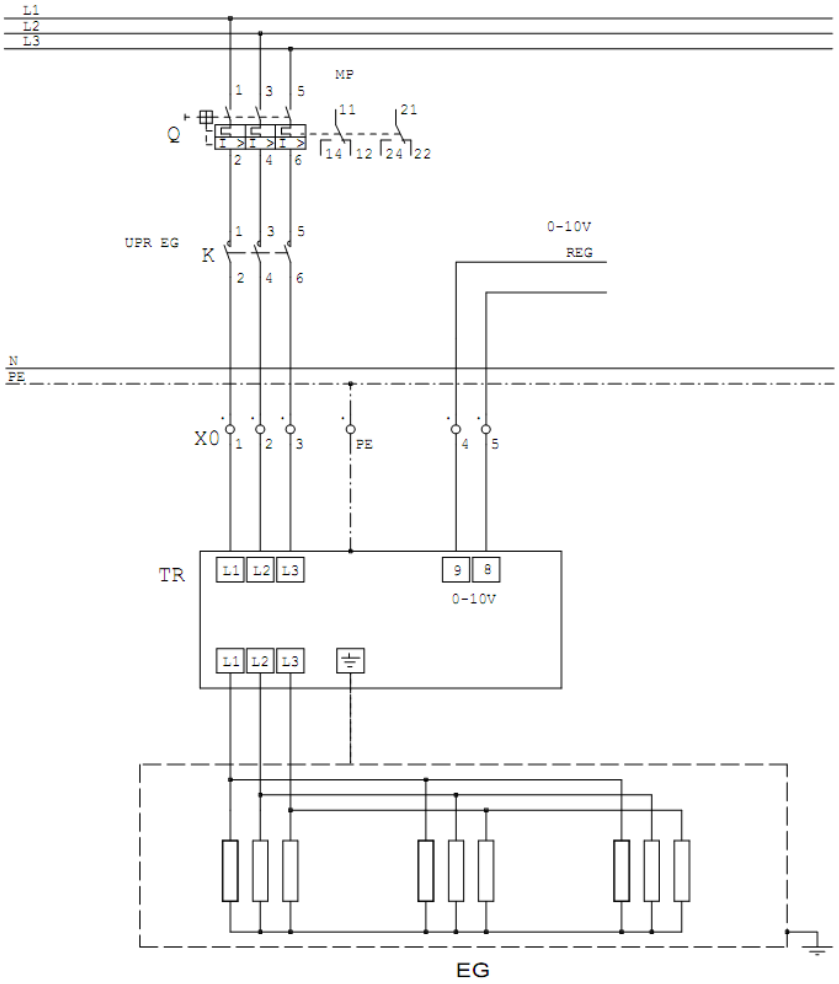
3.6 ELECTRIC HEATERS



An electric heater must be connected in the manner that prevents its activation when the fan is not running. Besides, when putting the fan out of operation it must be provided that the electric heater is switched off too. Each electric heater coil is connected separately to the connection box, placed generally on the external side of the electric heater unit panel, on the service side of the unit. Electric heater components are accessible after dismounting the service panel of the electric heater unit.

Depending on the automatic control system applied the control of heater capacity may be continuous or in steps. For a step control of heater capacity coils must be joined in groups of three (heating units are not factory-divided into groups). The electric heater casing has ground connections and connections for a safety thermostat that provides overheating protection of the electric heater in case no airflow or insufficient airflow. The safety thermostat is factory-set to a temperature value at which the electric heater power supply is cut off. The reset of the safety thermostat after activation is must be done manually.

3.6.1 CONNECTION AND CONTROL OF ELECTRIC HEATER OVER THYRISTOR CONTROLER



Legend:

Q – Motor switch
EG – Electric heater
TR – Thyristor controller
UPR EG – Electric heater on/off
MP – Motor protection switch
REG – Power control signal

X0 – Terminal label

WARNING After installation, it is necessary to install and check the safety thermostat in heater control system

3.7 AUTOMATIC CONTROL COMPONENTS AND CONTROL PANEL

Automatic control components and control panel is not delivered standard with air handling unit, but on customers request. Automatic control is integral part of each ventilation system, enabling the normal operation. Lack of regulation might cause problems in operation, malfunction or damage of the unit.

This manual does not include documents and information for installation of automatic control components for commissioning, service and maintenance. Ask the Manufacturer or automatic control components supplier for additional manuals and instructions. In all other cases, automatic control supplier is obligated to provide appropriate user manuals for installation, commissioning and maintenance.

Components of control panels are depending of unit function, scope of functions it monitors or controls, special customer requests or design conditions stated in design documentation.

If delivered, control panel should be placed on a space in machinery room according to design documentation. Control panel should not be placed on open space, exposed to rain or direct sunlight. Control panel should be placed as close as possible to the unit, and if this is not possible, control panel should be placed near the other automatic control devices in machinery room.

Smaller control panels are mounted to the wall with screws and mounting components (delivered by the installation company). Bigger panels are delivered in stand-alone casings. It is also recommended to mount the stand-alone panels to walls.

After installation, main power supply cable should be laid down and connected to control panel. Then, connect properly the field control components (sensors, actuators etc.) with control panel according to specification in design documents. Electrical cables should be properly labeled on both ends, laid on trays and glands. All blind holes should be blocked with rubber covers.

WARNING Connection of main power supply cable in control box should be done when control box in disconnected.

CALIBRATION

After connection of filed components and wiring to control panel, check of signals and calibration of sensors and measuring devices should be done.

Permissible calibration tolerances are in table. Minutes of measurements on calibration process is done on start-up check list – see APPENDIX B

Sensor	Permissible tolerance (+/-)	Sensor	Permissible tolerance (+/-)
Cooler	1.0 °C	Flow control, liquids	4% of range
Wet bulb thermometer	2.0 °C	Oxygen and CO2 sensors	1% of range
Heater	2.0 °C	CO sensor	0.6 ppm / °C
Outdoor air temperature	1.5 °C	Flow control, air	10% of nominal
Relative humidity	4%	Pressure difference sensor	5 Pa
Temperature in room	2.0 °C	Pressure switches	2% of range
Calorimeter, amper-meters, voltmeters	4% of range		

4 PREPARATIONS FOR INITIAL COMMISSIONING

Check and setup of refrigerant system – compressors, evaporators and condensers - filled with refrigerants should be done by authorized service personal.
Connection to installation, setup and commissioning of gas or oil burner, should be done by qualified service personal authorized by the burner manufacturer or local authority.
It is not recommended to run pumps „on dry“ because of possible damages.

WARNING Unit operation with service doors opened or access panels removed is not allowed.

NOTICE Before commissioning, please make a pre-check and fill in the start-up pre-check list- see **APPENDIX A**.
After pre-check, follow the commissioning instructions and fill the commissioning check-list – see **APPENDIX B**.

5 COMMISSIONING

5.1 GENERAL

Commissioning should be done by authorized service personal, authorized by the Manufacturer.

Check and setup of refrigerant system – compressors, evaporators and condensers - filled with refrigerants should be done by authorized service personal.

Commissioning of gas or oil burner, should be done by qualified service personal authorized by the burner manufacturer or local authority.

NOTICE

Before initial commissioning, by-pass damper should be closed.

On initial commissioning of unit with absolute filters installed, instead of original filter inserts use perforated screens to simulate the pressure drop on filter inserts.

On initial commissioning of unit with double stage filters is recommended to perform without fine filters installed. Fine filters should be installed after cleaning the space and final commissioning done.

Commissioning should be done only after the unit is connected properly to ventilation duct system, all installations of media supply (gas, oil, water, and refrigerant) and closing of all service doors and access panels.

Condition to start with commissioning procedure is to do all checks and fill start-up pre-check list – see **APPENDIX A**

Initial commissioning is done only once after the connection of unit to ventilation system. It lasts for a day per each unit.

Commissioning is done with dampers on supply side partly closed, to avoid motor overload. Check if automatic control opens the damper in operating position after the operating motor turnover is reached.

The fan operating level has been set in accordance with the data indicated. After the unit has been started and the dampers are opened, it is necessary to check:

- the rated current drawn by the motor and
- the vibration in normal and there is no unusual sounds

After initial commissioning, it is necessary to:

- turn off the unit and check all the components
- check filters (dirtiness, mechanical damages)
- check function of condensate drains
- check belt tension, temperature of fan and motor bearings (see chapter 6)
- measure and control for some time the level of microorganisms in circulating water of humidifiers and compare to normal values. If allowable number of germs is exceeded, immediately clean and disinfect the humidifier.

Couple of days after commissioning, new cell pads and droplet separators does not reach the full efficiency and droplet separation because of wetting effect.

If the ventilation ducts are done by the project documentation, it is necessary to make balancing (TAB) of the air flows through inlet and outlet grills. When air volume flow reaches values specified by the project, current drawn by the motor should not be bigger than nominal current.

In case the air volume flow is smaller or bigger then design value of air flow, it is necessary to make setup of belt drive (variable pulley) of motor or changing the pulley, carefully to avoid motor overload. Air flow should be chosen by using the tested methods for measurements like ISO 5221.

NOTICE The starting of the unit may, for a short time, be accompanied by a smell of burning coming from dust deposited on heating components. If the smell persists check the functioning of heating components (electric heaters, thermostats).

5.2 COMMISIONING IN WINTER CONDITIONS

The frost protection thermostat operation may only be checked when the temperature of air flowing to the heat exchanger is below the thermostat limit. This must be checked when the fresh air temperature is from +1°C to +2°C. Close the heating medium supply to the exchanger when the unit is in normal operation and observe whether the thermostat will turn on. The procedure described must be carried out before starting the unit for winter operation.

Check the proper function of heating components (if installed) like drain pan heater, siphon heater, heater of hydraulic module, heater of damper fins etc.

Check the proper function of pipe insulation, casings and other components exposed to possible freezing.

5.3 AUTOMATIC CONTROL COMPONENTS AND CONTROL PANEL

Automatic control components includes: DDC control and field components (sensors, valve and damper actuators etc.) factory mounted on the unit or delivered loose (packed separately).

NOTICE Installation of field components would be done by the qualified personal, following the branch rules, standards, guidelines and local regulation.

Components delivered with the unit are factory set according to design conditions. Before commissioning, check for proper installation, connection of DDC controller and default values.

Installation of field components is instructed in technical data sheets of component manufacturer and is not a part of this manual. Please ask for additional instructions from nearest representative or sales office of specific component.

User manual, options and a list of possible errors of DDC controller and instructions for troubleshooting is delivered with control panel (if in scope of Manufacturer) or by third party.

Control panel should have permanent power supply 3x400V/50Hz or 1x230V/50Hz, depending of nominal data of the unit. By switching to position 2, the operation of automatic control components and control panel is enabled. Protective relays and motor switches must be in operating position.

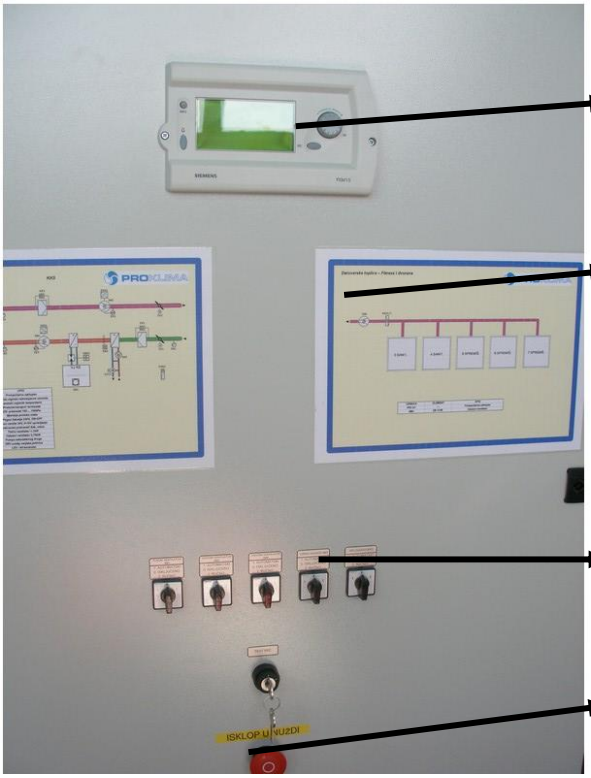
When unit is out of operation, sensor of outside air connected to controller monitors the outdoor temperature. When the temperature reaches close to 0 °C, controller turns circulating pump in secondary circuit of the heater and opens the heating valve.

In case the control panel is delivered without control switches, complete start-up and regulation of the system is done through DDC controller and its control panel.

Turning on the system and setting the system is done through the operating panel position 1. Unit is turned on and following data could be read from the screen: temperature, operating mode, opening position of a heater etc. Detailed description of parameters please checks in DDC controller user manual.

The error status may be read in the last two lines of the display, i.e. in Pos. 1 – at that moment the red light will turn on.

The control panel has the following:



NOTICE The control switch-box photo serves as an example only. The actual appearance and scope of control switch-box options may vary, depending on the unit configuration and the customer's request.

5.4 DESCRIPTION OF AHU AUTOMATIC CONTROL OPERATION (EXAMPLE)

Unit start-up:

Turning on of supply and exhaust fan, temperature regulation active, duct pressure regulation active.

Opening of supply and exhaust damper

Overview of regulation parameters

	Parameter description	Lower limit	Set-up value	Upper limit
1	SPV temperature - heating	14°C	17°C	28°C
2	SPV temperature - cooling	18°C	18°C	32°C
3	SPV supply fan	200Pa	400Pa	2000Pa
4	SPV exhaust fan	200Pa	250Pa	2000Pa

SPV – default set-up value

Regulation of air temperature – supply discharge

Design temperature if kept by the automatic DDC control. Leading value is temperature on supply discharge in room (temperature sensor 1B2). Depending of measured temperature, controller is regulating the work of heater or cooler valve.

By opening of regulating valve more than 5 %, circulating pump is turned on.

Pressure regulation – supply / exhaust

Desired pressure is kept with automatic DDC control. Leading pressure on supply / exhaust (temperature sensor 1F4/1F5). Depending of measured pressure, controller affects the frequency converter of supply/exhaust fan.

Control functions and alarms

Selection of local/automatic control

All selection switches for fan motors and pumps must be in position AUTO. Setting of any switch to MANUAL is not allowed in normal operation.

*** Frost protection

System is protected from freezing with frost protection sensor (1B9) installed after the heater on air side. Alarm set point (temperature < 5°C) is causing shutdown and blocking of the system (opening the valve to 100%, turn on the heater pump). Increase of temperature above 5°C valves is closed and pump is turned off. After the alarm state is reset and system being unblocked, system is turned on again.

*** Fire alarm

Receiving the fire alarm state from main fire alarm station is causing the shutdown and blocking the system. After the alarm state is reset and system being unblocked, system is turned on again.

** Thermal protection of frequency converter

Frequency converter has the overloading protection. Alarm appearance is causing the shutdown of the system. After the alarm state is reset and system being unblocked, system is turned on again.

** Thermal protection of pump motor

Pump motor have the overloading protection. Alarm appearance is causing the shutdown of the system. After the alarm state is reset and system being unblocked, system is turned on again.

** Differential pressure switch (filter)

Differential pressure switch on filter (1F1, 1F3) monitors the filter dirtiness. After the alarm state is reset and system being unblocked, system is turned on again

6 MAINTENANCE

6.1 GENERAL

WARNING	When replacing or cleaning the unit interior the fan unit is to be switched off
WARNING	Risk of eye damage or burns. Turn off the UV-lamp before service or use appropriate personal protection.
WARNING	Risk of gas explosion or oil burn-out. Do not use open flame near burner engine or gas/oil reservoir.
WARNING	Risk of electric shock. DO not use water for cleaning. Use vacuum cleaner or compressed air for dirt removal.
CAUTION	Do not operate without appropriate filter inserts because of possible burn-out of motor winding due to overload!
CAUTION	Hot parts. Use personal protection cloths to avoid burns.
CAUTION	Do not use open flame in presence of refrigerant gas of explosive concentration near service area.
CAUTION	Ensure carrying personal protective cloth during service or maintenance.
NOTICE	During plate exchanger fins defrosting, by-pass damper should be closed, and during commissioning by-pass damper should be partly closed.
NOTICE	During cleaning of coils with compressed air or high pressurized warm water, watch out to avoid for possible fins damage.
NOTICE	Do not release refrigerants in environment! In case of need to add or reduce the refrigerant quantity, service personal should follow all standards and local regulations for refrigerants.
NOTICE	Change of filters, belts and other expendable parts is obligation of end user. Cost for supply of new parts and its replacement bear the end user. Maintenance and service of unit should be done by qualified personal authorized by the Manufacturer.

Basic technical data of expendable spare parts are specified on spare parts list, delivered with warranty letter. Spare parts list includes the list of parts which must be regularly replaced because of dirtiness or worn (filters, bearings, belts, sealing etc.).

During maintenance or cleaning please follow the remarks below:

- Use industrial vacuum cleaner, air compressor (for blow out with air in direction opposite the air flow through the unit) max. Air pressure of 3 bar or mini-wash device for cleaning with warm water and addition of cleaning agent not causing the aluminium corrosion (water pressure should not be higher than 1,5 bar, and water temperature max. 80 ^{o}C)
- For smaller dirt deposits use rag, if necessary, with agent for grease and oil removal (non-aggressive agent with pH-value between 8 and 9).
- Put protective layer by spraying the galvanized parts.
- Put protective layer on all movable parts, like door handle, connectors and etc.
- Put a protective layer of Vaseline or glycerin on sealing, especially on door gaskets,
- Remove damaged protective layers or corrosion by using the new protective layer
- Before next commissioning, remove all used material or tools for cleaning from the unit.
- Toxic or scent intensive materials should be ventilated before commissioning, to avoid poisoning of supply air stream.
- Use non-aggressive materials on alcohol basis, appropriate for intended use
- Read carefully the safety data sheets (SDS) of used chemicals for cleaning, study the precautions and first aid procedures on possible accidents, according to EC 1907/2006

Metal filter inserts could be washed with warm water with addition of normal agent for washing with steam. In case of mechanical damages of filter inserts, please replace with new one.

Filters from synthetic material arte replaced with new ones when filtration is of dirt from air stream is not done or pressure switches indicate limited final pressure (see attached table for recommended final pressure drops).

Filter class	Recommended final pressure drop
G1-G4	200 Pa
M5-M6	200 Pa
F7-F9	300 Pa
E10-E12	400 Pa
H13-H14	450 Pa
U15-U17	500 Pa

New filter inserts must comply with original in dimensions and filter class. On each filter inserts replacement it is necessary to clean the internal surfaces of filter unit and filter frames. Unit must be turned off when filters are being replaced because of protection from entering dirt in the unit.

Replacement of filter inserts on smaller units is done from access side by pulling out the filter frame(s) with filter inserts. On most of the units, before filter unit there is a free service space for removing filter inserts from filter frame one by one. Be aware of local regulations for waste deposit of dirty filter inserts.

When changing filters, check the quality of sealing and gaskets.

Number of filter inserts, type, class and dimensions are listed on spare parts list, delivered with warranty letter.

Before washing of evaporator coil fins with water, it is necessary to remove the refrigerant and put it in the receiver through the service valve on evaporator outlet connection, to avoid unexpected pressure raise of the refrigerant in pipes, pipes or connection damages.

Qualified personal for handling with refrigerants should check the parameters of refrigerant in the system.

Function of electric heater should be periodically checked, mostly before winter mode. Check the electrical connections and function of safety devices (thermostats, fuses etc.). It is necessary to remove the dirt deposits, especially before heating period in winter time, because burn-out of dirt on bars produces an unpleasant smell and increase the risk of fire.

Function of humidifiers mostly depends on design solution of fresh water treatment. To reduce the concentration of minerals in drain pan (evaporated air carry over the pure water), it is necessary to provide normal water flow. This is especially important when fresh water connection is done directly from public water network, without the water treatment device. Moisture, high temperature, oxygen concentration, sludge of lime scale or corrosion increases the microorganisms, fungi and bacteria. This can cause a lot of different allergies and sickness.

Measures for reducing the risk and prevention of microorganisms and fungi growth:

- Prompt sludge let-off (once or twice per month)
- Prompt cleaning and disinfection of humidifier unit
- Usage of softened fresh water and usage of chemical and mechanical material for sterilization
- In case the unit is out of operation longer than 3 or 4 month or during summer period, clear, clean and dry the water tank and flush the entire system before the operation
- Regularly check fresh water level in drain pan, and if necessary, adjust the floating valve.
- Regularly check the circulating pump and fittings
- Monitor the limit values of water quality and compare it with the values specified in the guideline VDI 3803

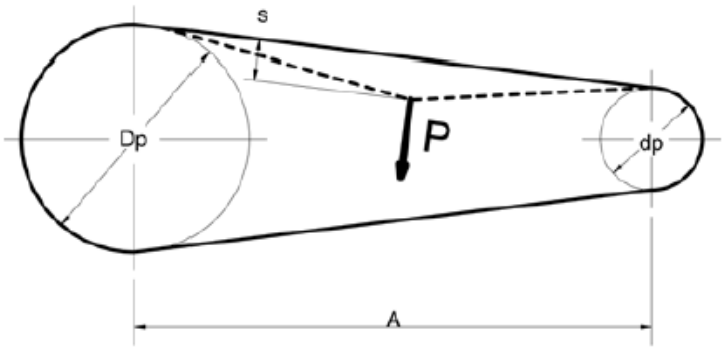
Maintenance of humidifier or other additional equipment (for e.g. UV-sterilizer) should be done according to the user manuals of components manufacturers, delivered with the unit technical data.

BELT DRIVE

NOTICE Following instruction are valid for V-belt drives. Instructions for belt drives with different type and shape (for e.g. flat belt drive, if installed) are delivered with the unit or provided by the Manufacturer (on request).

BELT TENSION

Belt tension must be regularly checked and adjusted. If the belt tension differs from the values indicated below the belt tension is to be adjusted by moving the motor by means of a belt tensioning screw located laterally on the electric motor base. Belt tension values are to be adjusted to the values indicated below. Over-tensioning causes overload, overheating and damage to bearings, and slack belts cause slippage and wear excessively.



Recommended sagging force **«P»** for determining of belt tension depends of belt type and dimension of smaller pulley **(dp)** and it could be determined from the table:

Belt type	Diameter of smaller pulley [mm]	Turnover speed of smaller pulley [min $^{-1}$]	Force of belt strain P [N]
SPZ	50 – 90	1200 – 5000	10 – 15
	100 – 150	900 – 1800	20 – 30
	155 – 180	600 – 1200	25 – 35
SPA	90 – 145	900 – 1800	25 – 35
	150 – 195	600 – 1200	30 – 45
	200 – 250	400 – 900	35 – 50
SPB	170 – 235	900 – 1800	35 – 45
	250 – 320	600 – 1500	40 – 60
	330 – 400	400 – 900	45 – 65
SPC	250 – 320	900 – 1800	70 – 100
	330 – 400	600 – 1200	80 – 115
	440 – 520	400 – 900	90 – 130

Recommended deformation „s“ depends of pulley type and axle distance **(A)** and is possible to calculate like:

s [mm] = A [mm] x 1,5 / 100

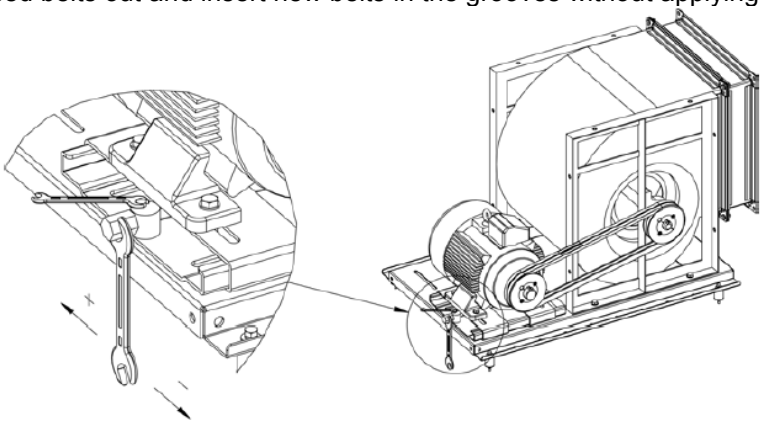
Depending of customer request or project design parameters, it is recommended to use variable pulleys to slightly adjust the turnover speed and air volume flow Variable pull drive is usually installed on motor shaft. Instructions for change or setup of variable drive are attached with the unit or provided by the Manufacturer (on request)

BELT REPLACEMENT

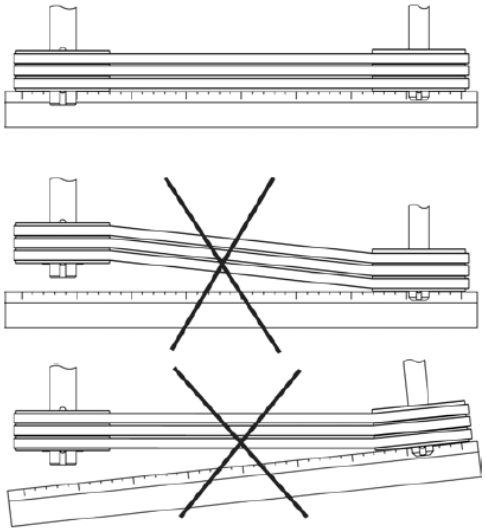
In case that a belt is damaged it is necessary to replace all belts, of the drive, making sure that all of them are of equal dimensions and adequate cross-section that corresponds to the size of the pulley groove.

To ensure the purchase of matching pulleys needed for replacement, all data about the type and dimensions of factory-mounted pulleys are specified in the Spare Parts List accompanying the warranty.

In order to avoid damage during replacement, the electric motor setscrew on the side of the motor base is to be loosened (see the drawing), and the motor moved closer to the fan to make it possible to pull the used belts out and insert new belts in the grooves without applying force.



After that the belts are to be tightened making sure that pulleys are in alignment. If the belts are mounted correctly, the drive must rotate smoothly. Replaced belts are to be checked again after 50 hours of operation.



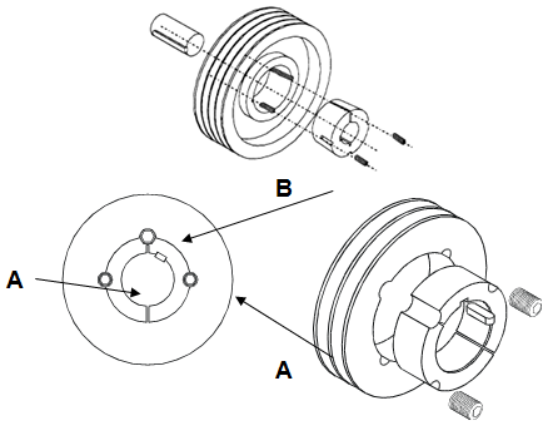
CORRECT

WRONG!!

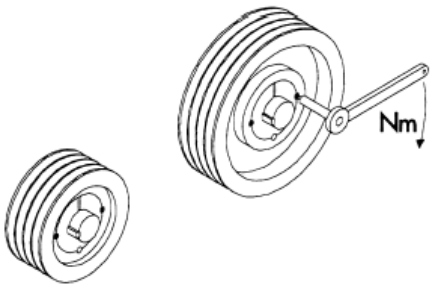
PULLEY REPLACEMENT

Check the pulleys for functionality, grooves, screws and other moving parts.
For moving the pulley for alignment or replacement, do the following:

- degrease and clean all surfaces (shafts, holes, threads, etc.);
- slide the pulley on the motor shaft and insert the taper lock sleeve;
- turn the pulley until holes on the pulley are in line with holes on the taper lock sleeve;
- insert screws into the holes and tighten them in place making allowance for endplay of the pulley;
- align the electric motor shaft and the fan shaft;
- adjust the alignment of pulleys (horizontally and vertically);
- tighten the screws by a torque wrench (according to the table enclosed)



NAPOMENA When mounting a pulley, first insert the screws in "A" holes and when dismounting the pulley, pull out the "B" screws first.



Locking ring type	Screw torque (Nm)	Screw	
		Pcs.	Size
1008	5,6	2	1/4"
1108			
1310	20	2	3/8"
1315			
1210	20	2	3/8"
1215			
1610	20	2	3/8"
1615			
2012	31	2	7/16"
2517	48	2	1/2"
3020	90	2	5/8"
3030			
3535	112	3	1/2"
4040	170	3	5/8"
4545	192	3	3/4"
5050	271	3	7/8"

The deviation of inclination of the pulley against the horizontal axis must not exceed 0.5°.

When replacing pulleys with the same characteristics, technical data of type and dimension is specified on the spare parts list, delivered with the warranty letter.

INSPECTION, LUBRICATION AND REPLACEMENT OF BEARINGS

It is recommended to check the bearings by hearing the sound produced during normal operation. For that, put the screwdriver on bearing casing and hear the sound. If the sound is quiet and like buzzing, bearing is operating normally. Otherwise, noise from bearings indicates the lack of lubricant. Hearing of metal sound like bumping means damage of bearing and bearing should be replaced.

Most of the bearings installed are self-lubricated for-life. Lubrication of bearing not lubricated for life (depending of type and manufacturer) are done through special lubrication inlet on bearing casing. Bearings are lubricated with bearing lubricant, in intervals depending of intensity of unit operation and bearings condition. Type of lubricant should be checked in the bearing manufacturer technical data sheet. It is recommended to lubricate once a year (in case unit is operating approx. 8 hours per day) or twice per year (in case unit is operating all day). Input of lubricant in bearing is causing slight warm-up, especially on high shaft turnover speed. After several lubrications, it is recommended to open the bearing and remove the old lubricant before adding the new one.

On replacement, technical data of bearing type and dimension is specified on the spare parts list, delivered with the warranty letter.

In case of bearing removal, it is necessary to remove the pulleys and belts from the shaft and support the shaft. Replace the bearing with the same bearing (type, size) or bearing of some other manufacturer with same characteristics. To avoid possible vibrations and resonance, it is recommended to replace both bearings at the same time.

Use only tools and equipment (for e.g. cotton rags) according to EN 1127-1 to avoid sparking. Use appropriate cloths to avoid static electricity.

6.2 RECOMMENDED INSPECTION AND MAINTENANCE INTERVALS

Schedule in tables below represents basic recommendations of the Manufacturer and do not represent the rule for all types of unit usage. Recommendations are valid for annual operation of 4000 operating hours with air of normal cleanness.

Description	Type of inspection
Fundamental visual check of the unit and components, minor internal cleaning	R – Regularly
Check the filter dirtiness, functional check of moving parts and components	P – Periodically
General inspection and service	A – Annually*

*- depending of unit usage, interval could be shorter or longer

Description	Recommended interval of check		
	R – Regularly	P – Periodically	A – Annually*
Units in standard design	3 months	6 months	12 months
Other designs (hygienic, pool, ATEX, etc.)	1 month	3 months	6 months

Intervals of inspections, cleaning and maintenance should be adjusted to real needs, pollution of the air, possibilities for maintenance, local regulations and situation on site, and intensity of unit operation and usage.

6.3 MAINTAINANCE OF UNITS IN HYGIENIC DESIGN

Air handling units of hygienic design (KU and KEK series) are developed specially for highly demanding ventilation and conditioning systems used in clean spaces such as hospitals, operating rooms, laboratories, pharmaceutical and electronic plants, etc.

The hygienic design of a unit differs from a standard design in the following points:

- The materials used are not harmful for human health and are not favorable for the growth of harmful microorganisms.
- Internal unit surfaces are made of materials highly resistant to tear and wear, cleaning and disinfecting.
- All air-conducting components are easily accessible for checking, cleaning and disinfecting operations.
- If the air-handling system has envisaged air humidification, the first air filter stage is constructed at least in class F6.

During maintenance and cleaning of unit in hygienic design, take care to do the following:

- Use normal agents for washing and disinfection, in normal concentrations. Cleaning agents for washing and disinfection should not be aggressive, flammable or poisoning
- Use high quality rags and equipment which is not damaging the surface or release whiskers
- Parts possible to be pulled out of the unit (fans, motors, filters, coils, etc.) should be carefully disassembled and carefully pull out by factory mounted guides and mechanisms. After cleaning and disinfection check and remove all cleaning rags and equipment from unit guides and mechanisms.
- Tighten all previously disassembled parts
- Close all the access doors and panels opened and removed for easier access to unit internal parts

REMARK Maintenance and cleaning of units in hygienic design should be done by qualified and educated personal (category B, according to VDI 6022 part 2).

For efficient maintenance it is recommended to follow the guidelines VDI 6022 part 3, VDMA 24186-1, VDMA 24186-4 and keep the maintenance log (according to guideline VDI 6022) and other relevant local regulations.

During maintenance and service it is necessary to follow the instructions and advises below and special instructions of the component manufacturers (motors, humidifiers, burners, etc.) delivered with the unit or provided by the Manufacturer (on request).

Maintenance and service records for the unit is kept on service logbook (see - **APPENDIX D**).

6.4 RECOMENDED SCOPE OF MAINTENANCE

	Dampers	R	P	A
OZ1	Check cleanness, damage, corrosion	✓		
OZ2	Check function of blade rotation, actuators and rods		✓	
OZ3	Keep blades, rubber sealing, bearings, rods and frame clean		✓	
OZ4	Inspect and maintain rubber sealing. If necessary, protect the rubber with ant-aging lubricants (glycerin) or replace with new rubber		✓	
OZ5	Inspect and lubricate the connection of actuator and shaft with graphite or lithium lubricants. Take care of lubrication due air produce degreasing effect when flowing through the lubricated connections		✓	
OZ6	Check functionality and tightness of damper			✓
OZ7	Check functionality and tightness of regulating and safety devices			✓
	Filters			
OF1	Check cleanness, damage, corrosion	✓		
OF2	Check the dirtiness of filter inserts (measuring the pressure difference with manometer). Immediately replace in case of dirtiness, damage or odor		✓	
OF3	Check sealing and leakage between frame and filter border			✓
	Coils			
OL1	Check cleanness, damage, corrosion	✓		
OL2	Check inlet/outlet connection		✓	
OL3	Check the frost protection		✓	
OL4	Check and clean droplet separator and drain pan		✓	
OL5	Check functionality of drains and siphons. If necessary clean and fill siphons with water		✓	
OL6	Check direct expansion for freezing			✓
OL7	Check regulation and safety components (on condensers and evaporators)			✓
OL8	Check inlet/outlet of coil			✓
OL9	Check frost protection			✓
OL10	Clean the coil fins			✓
	Electric heaters			
OE1	Check cleanness, damage, corrosion	✓		
OE2	Tighten the connections		✓	
OE3	Check regulation and safety components			✓
OE4	Clean the heater bars			✓
	Air washer, honeycomb humidifier			
OO1	Check cleanness, damage, corrosion	✓		
OO2	Check water inlet and drainage	✓		
OO3	Empty drain pans and flush with clean water		✓	
OO4	Check the internal surfaces for visible or tangible biological residue, bacteria, damages or corrosion- If necessary, clean the surface manually or with high-pressure washer and disinfect. If full of lime scale, add the anti- lime scale agent with fans in standstill. Leave for couple of hours. Empty the		✓	

	pans and flush with clear water. If necessary, remove the droplet separator and guiding rails.			
OO5	Check the proper function and conductivity of clean electrode to be according to manufacturer specifications, correct if necessary		✓	
OO6	Check the precipitator, pump and piping's for cleanness, functionality, damage and corrosion. Flush with clean water if necessary.		✓	
OO7	Check and clean the drainage		✓	
OO8	Check the pump including bearings, start-up, warming-up, noise and correct if necessary			✓
OO9	Check and adjust (if necessary) pump protection for work „on dry"		✓	
OO10	Lubricate the bearings of pump motor according to manufacturer specifications.			✓
OO11	Unscrew the spray nozzles and test for residues and deposits. Clean if necessary			✓
OO12	Check the floating valve		✓	
OO13	Check the functionality of dose and safety equipment, sterilizers, drainage and overflow. Correct and clean if necessary.			✓
OO14	Check the water cleanness (KBE/ml)		✓	
OO15	Check the filling of humidifier receiver with water			✓
	Steam humidifiers			
ON1	Check cleanness, damage, corrosion	✓		
ON2	Check the function of steam distributors, steam and condensate pipes	✓		
ON3	Check the water quality (hardness, microbiological quality) to correspond local regulations and guideline VDI 3803		✓	
ON4	Check fittings (valves etc.)		✓	
ON5	Check and clean drainage		✓	
ON6	Check and cleaning of steam and condensate pipes			✓
ON7	Check and cleaning of cylinders		✓	
ON8	Check regulation and safety components			✓
	Plate heat exchangers			
OP1	Check cleanness, damage, corrosion	✓		
OP2	Check functionality of by-pass damper, drainage, pans, droplet separators and siphons. If necessary, clean and fill the siphon with water. If exchanger is used on temperatures below 0 ^{o}C, fins must be dried before commissioning.		✓	
OP3	Check functionality of drainage and siphons		✓	
OP4	Check regulation and safety components			✓
	Rotary heat exchangers			
OR1	Check cleanness, damage, corrosion	✓		
OR2	Check functionality of installed equipment (speed controller, motor, and belt drive, sealing brush), detrition and tightness. Replace the belt (if necessary). If exchanger is used on temperatures below 0 ^{o}C, fins must be dried before commissioning			✓
OR3	Check the motor including bearings, start-up, warming-up, noise and correct if necessary			✓
OR4	Check that wheel is rotating easily and quietly		✓	
OR5	Lubricate the bearings. Replace the bearings (if necessary)			✓
	Unit with burners			
OC1	Check cleanness, damage, corrosion	✓		
OC2	Remove the dirt and soot residues. General cleaning should be done before heating season (winter time).		✓	
OC3	Check functionality of installed equipment (bypass dampers, valves, pipes, thermostats, controllers etc.)			✓
OC4	Check regulation and safety components			✓
	Compressors (integrated cooling)			

OK1	Check cleanness, damage, corrosion	✓		
OK2	Check regulation and safety components			✓
OK3	Check the installation for leaks			✓
	Fan unit			
OV1	Check cleanness, damage, corrosion	✓		
OV1	Check the belt tension and replace the belts (if necessary)		✓	
OV3	Check that fan wheel is rotating easily and quietly		✓	
OV4	Check the parts (fan, motor, belt drive, isolators, bearings and flexible canvas). Clean, lubricate or replace (if necessary)		✓	
OV5	Check the sealing of flexible canvas		✓	
OV6	Check regulation and safety components			✓
	Control panels			
OU1	Check cleanness, damage, corrosion	✓		
OU2	Check the operating conditions (ambient temperature and humidity)		✓	
OU3	Check the integrity of protective insulation		✓	
OU4	Clean the components with rags or brushes without using water. Tighten the connections		✓	
OU5	Check electrical / mechanical connections, especially the safety components		✓	
OU6	Check the functional units (screens, controllers etc.)			✓
OU7	Check the input signals (for e.g. sensors, reference values) to correspond with default settings. Adjust if necessary			✓
OU8	Check the switches and control relays for detrition and damage (for e.g. erosion of the contacts)			✓
OU9	Check control processes (for e.g. frost protection function)			✓
OU10	Check safety components			✓
OU11	Check the settings of control panel components (for e.g. time relays)			✓
OU12	Check the function of manual, automatic or remote operating modes			✓
OU13	Adjust the values (if necessary)			✓
	Regulators, sensors, safety or monitoring equipment and field components			
OA1	Check cleanness, damage, corrosion	✓		
OA2	Check the operating conditions (ambient temperature and humidity)		✓	
OA3	Check the integrity of protective insulation		✓	
OA4	Clean the components with rags or brushes without using water. Tighten the connections		✓	
OA5	Check the connections on electrical power supply and control panel, especially protective cables		✓	
OA6	Check the electrical, electronic and pneumatic measuring signals		✓	
OA7	Adjust the values (if necessary)			✓
	Other parts of the unit			
OX1	Check cleanness, damage, corrosion	✓		
OX2	Check regulation and safety components			✓
OX3	Inspect general condition of parts, functionality, sealing, dirtiness, detrition, tightening, clean and adjust (if necessary)			✓

Spare parts must comply with special rules for ATEX-classification (category, atmosphere, temperature class). It is recommended to use identical original parts. Declaration of conformity is void in case of inadequate replacement on units by the third party (unauthorized personal).

Use only ATEX certified parts for installation in ATEX devices. All electrical parts must be grounded.

Regularly inspect the ATEX units according to local regulations.

7 TURNING OFF AND LONG INACTION PERIODS

Unit may be only turned off by switching off the main switch of power supply or by automatic control system, installed in control panel.

Short periods of shut down for maintenance and service work are allowed by switching off the motors with service switches (if installed). Service switch is installed on fan unit.

On long inaction periods of the unit, take care to avoid freezing of medium in coil pipes, and to drain out all condensate from drain pans.

Heater coils should have frost protection thermostats installed or filled with anti-freezing medium (for e.g. ethylene-glycol mixture of appropriate concentration). If temperature in inactive periods might fall below +4 ^{o}C, coils should be drained on drain pipe on lower part of the outlet collector pipe, and flushed with compressed air to remove residual moisture.

During shutdown or inactive periods, medium flow through coils should be reduce to minimum, so the temperature raise inside the unit do not exceed +60 ^{o}C. Exceeding this temperature might damage some unit components (like motors, bearings, plastic parts etc.).

Periodically (2 or 3 time a year) it is necessary to turn the fan wheel, shaft of motor, pump, wheel of rotary heat exchanger and other rotating parts with bearings, to enable normal lubrication and avoid bearing and shafts damages.

After long period of unit inaction, and before start-up, it is necessary to check the condition of casing, inlet/outlet openings, installed parts and components for functionality, cleanness, damages and corrosion.

Start-up of the unit should be done according to instructions in chapter 4.

8 CHECK MEASUREMENTS

During regular inspections and maintenance, it is necessary to check operating parameters like:

- Measurement of temperature and humidity of air before and after the component, treating the air in a matter of changing the temperature or humidity
- Measurement of temperature and other operating parameters of heating or cooling media
- Measurement of total pressure drop on fan
- Measurement of nominal current of all electrical components

According to local regulations, service logbook should be kept.

9 SAFETY PERSONAL PRECAUTIONS

1. Connection and commissioning of the unit must be done in conditions corresponding to local regulations, especially on a field of electrical equipment
2. Main power supply may not be turned on before the unit is connected to the safety system and grounded
3. It is prohibited to do maintenance or service until the main power supply of the unit is not turned off
4. It is prohibited to operate the unit with service doors opened or access panels removed.
5. Maintenance and service personal must have appropriate qualifications and a valid working permit issued by the competent public institutions.
6. The place of service must have necessary protective equipment which ensures safety during maintenance (emergency exit, first aid kit, fire extinguisher etc.)

10 DISMANTLE AND DISPOSAL

The expected lifetime of the device is 15 years within usage up to 4000 hours per year with regular and proper maintenance.

Do not dispose the device or it parts in your household waste.

Only an authorized waste disposal company can disassemble the unit after the end of unit lifetime.

Please observe the safety regulations of each component in accordance with local regulations and Manufacturers code instructions, in order to avoid any damages to people or inventory. All parts of the device should be disposed to environmentally friendly manner in accordance with local regulations.

All components must be recycled in accordance with local regulations. All metal and plastic components to be separated and recycled.

Basic plastic parts are made of polyvinyl chloride (PVC)

11 INFORMATION

Periodical checks of the entire unit carried out by qualified and competent maintenance and service personnel authorized and trained by PROKLIMA as the Manufacturer of the unit, guarantee many years of a reliable operation without shutdowns and defects. Our personnel is ready to assembly the unit supplied disassembled, to install the unit on the site, to put the unit into operation and carry out service, maintenance and is available to promptly provide assistance in emergency cases at any time and in any part of the world.

All data about the authorized service companies may be obtained from the Manufacturer or you may refer to the Manufacturer's website at www.proklima.hr.

For all additional instructions and assistance in troubleshooting do not hesitate to contact the manufacturer's personnel (phone no. +385 1/6546-343; fax no. +385 1/6546-344; e-mail: proklima@proklima.hr). We are always at your disposal.

APPENDIX A

REMARK: it is recommended to copy this blank checklist and fill it in during preparation for startup

Air Handling Unit Pre-Start-up Checklist

Customer:			
Project:			
Customers ref.:			
Our ref. No.:		**System:**	
Unit type :			
Serial No.:		**Year of production:**	

This checklist is not a substitute for reading and implementing the safety measures and precautions as set forth in the user's manuals. Regardless of manufacturer, the instruction manual should be read and thoroughly understood before starting any equipment.

Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event. Contractors' assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.

Please fill in contact data of responsible person on site which will enable the access of manufacturer's responsible person for start-up (service personal) and the name of person to be instructed for unit operation.

	Contact person on site (full name, phone):
Object address / Remarks:	Person to be instructed for unit operation (full name):

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below. In case some items from checklist is not completed or not properly done, I undersigned below, accept the work of manufacturer's responsible person for start-up to be additionally invoiced according to valid price list.

Place and date:	For contractor (full name, signature)

Filled and signed pre-start-up checklist please return to manufacturer or his local representative.

Contact data of manufacturer of other responsible person for start-up:

Air handling unit pre-start-up check list				
Check if acceptable, provide comment if unacceptable			**NA**	**Comment**
Unit				
RU01	Unit delivery sections/complete unit putted on baseframe, sections connected one with each other	☐	☐	
RU02	Casing condition good: no dents, leaks, door gaskets installed	☐	☐	
RU03	Factory-mounted components of the unit are not damaged during transport or assembly	☐	☐	
RU04	Access doors closed tightly – no leaks	☐	☐	
RU05	Protective foils and transport stiffening (necessary during transport) are removed	☐	☐	
RU06	Maintenance access acceptable for unit and components	☐	☐	
RU07	All parts and unit components are properly installed, according to user manual and manufacturer's specifications	☐	☐	
RU08	Drainage of condensate done (connection to drain correct, siphons installed properly and filled with water)	☐	☐	
RU09	Piping work of pump group done properly and labeled (upon specification), no leakage	☐	☐	
RU10	Thermal insulation properly installed and according to specification	☐	☐	
RU11	Heating/cooling media available for start-up	☐	☐	
Ventilation ducts				
RK01	Unit connected to the air duct work	☐	☐	
RK02	Connection between duct and unit tight and in good condition	☐	☐	
RK03	No apparent severe duct restrictions	☐	☐	
RK04	ODA intakes located away from pollutant sources & exhaust outlets	☐	☐	
RK05	Pressure leakage tests completed	☐	☐	
RK06	Branch duct control dampers operable	☐	☐	
RK07	Fire dampers mechanically properly installed and operable	☐	☐	
RK08	Balancing dampers installed as per drawings and TAB's site visit	☐	☐	
Electrical and Controls				
RA01	All control panels placed by air handling units and connected to power supply	☐	☐	
RA02	Filed elements properly installed and according to specifications (thermometers, pressure switches, sensors, flow controls etc.)	☐	☐	
RA03	Wiring of additional components installed (like humidifiers, heat exchangers, burners etc.)	☐	☐	
RA04	Wiring of field elements done properly (all wires labeled, prepared for connection and laid in cable trays, reentrant in panel and lead to automatic control elements on a unit)	☐	☐	
RA05	Wiring of fire dampers done properly	☐	☐	
RA06	Valves and valves actuators installed	☐	☐	
Documentation				
RD01	User manual for AHU available	☐	☐	
RD02	User manual for automatic control available	☐	☐	
RD03	Technical data (calculations etc.) available	☐	☐	
RD04	Warranty card, warranty conditions and spare parts list available	☐	☐	
Remarks:				

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REMARK: it is recommended to copy a blank checklist and fill in a copy during the preparation for start-up

Air Handling Unit Start-up Checklist

Customer:			
Project:			
Customers ref.:			
Our ref. No.:		**System:**	
Unit type:			
Serial No.:		**Year of production:**	

This checklist is not a substitute for reading and implementing the safety measures and precautions as set forth in the user's manuals. Regardless of manufacturer, the instruction manual should be read and thoroughly understood before starting any equipment.

Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This start-up checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed.

___ List attached.

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date	Sheet Metal Contractor	Date
TAB Contractor	Date	General Contractor	Date

Start-up checklist items are to be completed as part of startup and initial checkout, preparatory to functional testing. Contractor's assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Comments:			
Date and time of starting:		Date and time of finishing:	
Commissioning Authority	Date	Owner's/End customer Representative	Date

Air Handling Unit Start-up Checklist				
Check if acceptable, provide comment if unacceptable (NA)			**NA**	**Comment**
Supply fan		☐	☐	Type*:
PV01	Vibration isolation equipment installed & released from shipping locks	☐	☐	
PV02	Belt drive protection mounted	☐	☐	
PV03	Belt and belt drive properly mounted, aligned and tightened	☐	☐	
PV04	Fan rotation direction according to arrow on fan casing	☐	☐	
PV05	Fan blades clean, rotor is rotating freely	☐	☐	
PV06	Noise and vibrations in normal level and acceptable	☐	☐	
PV07	Fan turnover speed. Maximal allowed min-1	☐	☐	Nominal: Measured:
PV08	Motor properly connected. Rotation direction checked and correct	☐	☐	
PV09	Motor thermal protection properly mounted and set	☐	☐	
PV10	Input voltage (by phases). Allowed ±10% on all phases	☐	☐	Measured: / /
PV11	Deviation of voltage on motor in %. < 2% allowed	☐	☐	
PV12	Current drawn on nominal load	☐	☐	Nominal: Measured:
PV13	Motor current on maximal load (measured after the frequency converter)	☐	☐	Measured: / /
PV14	Measured current < Current on nominal load	☐	☐	
PV15	Sensor or pressure switch properly mounted and set Installed type: _____	☐	☐	
PF01	**Frequency converter** mounted, properly positioned, away from dust and moisture	☐	☐	
PF02	Frequency converter properly mounted on electric network with appropriate voltage	☐	☐	
PF03	Frequency converter mounted properly on automatic control system	☐	☐	
PF04	Power/current of frequency converter matches the motor power/current	☐	☐	
PF05	Input voltage (by phases). Allowed ±10% on all phases	☐	☐	Measured: / /
PF06	Deviation of voltage on converter in %. < 2% allowed	☐	☐	
PF07	Maximal speed set. Allowed: 100% or 60 Hz	☐	☐	Set:
PF08	Maximal speed set. Allowed: 50% or 30 Hz	☐	☐	Set:
PF09	Start-up/stop time set. Allowed: 10-60 s	☐	☐	Set: /
PF10	Parameter Auto reset on power failure set to automatic	☐	☐	
PF11	Security settings and codes for access set acc. to specifications and documented	☐	☐	
PF12	Switch between freq.converter and motor mounted and functional	☐	☐	
PF13	Connection of all electrical parts according to standards and attached wiring diagrams and schemes	☐	☐	
PF14	Protection of cables in cable trays done properly	☐	☐	
PF15	Service switches mounted and labeled	☐	☐	
PF17	All electrical connections tightened	☐	☐	
PF18	Device and all components properly grounded	☐	☐	
PF19	Safety devices mounted and functional	☐	☐	
*Type: centrifugal, plug-in, direct driven motor, other				
Extract fan			**Type*:**	
PV01	Vibration isolation equipment installed & released from shipping locks	☐	☐	
PV02	Belt drive protection mounted	☐	☐	
PV03	Belt and belt drive properly mounted, aligned and tightened	☐	☐	
PV04	Fan rotation direction according to arrow on fan casing	☐	☐	
PV05	Fan blades clean, rotor is rotating freely	☐	☐	
PV06	Noise and vibrations in normal level and acceptable	☐	☐	
PV07	Fan turnover speed. Maximal allowed min-1			Nominal: Measured:
PV08	Motor properly connected. Rotation direction checked and correct	☐	☐	
PV09	Motor thermal protection properly mounted and set	☐	☐	
PV10	Input voltage (by phases). Allowed ±10% on all phases	☐	☐	Measured: / /
PV11	Deviation of voltage on motor in %. < 2% allowed	☐	☐	

PV12	Current drawn on nominal load	☐	☐	Nominal: Measured:
PV13	Motor current on maximal load (measured after the frequency converter)	☐	☐	Measured: / /
PV14	Measured current < Current on nominal load	☐	☐	
PV15	Sensor or pressure switch properly mounted and set Installed type: _____	☐	☐	
PF01	**Frequency converter** mounted, properly positioned, away from dust and moisture	☐	☐	
PF02	Frequency converter properly mounted on electric network with appropriate voltage	☐	☐	
PF03	Frequency converter mounted properly on automatic control system	☐	☐	
PF04	Power/current of frequency converter matches the motor power/current	☐	☐	
PF05	Input voltage (by phases). Allowed ±10% on all phases	☐	☐	Measured: / /
PF06	Deviation of voltage on converter in %. < 2% allowed	☐	☐	
PF07	Maximal speed set. Allowed: 100% or 60 Hz	☐	☐	Set:
PF08	Maximal speed set. Allowed: 50% or 30 Hz	☐	☐	Set:
PF09	Start-up/stop time set. Allowed: 10-60 s	☐	☐	Set: /
PF10	Parameter Auto reset on power failure set to automatic	☐	☐	
PF11	Security settings and codes for access set acc. to specifications and documented	☐	☐	
PF12	Switch between freq.converter and motor mounted and functional	☐	☐	
PF13	Connection of all electrical parts according to standards and attached wiring diagrams and schemes	☐	☐	
PF14	Protection of cables in cable trays done properly	☐	☐	
PF15	Service switches mounted and labeled	☐	☐	
PF17	All electrical connections tightened	☐	☐	
PF18	Device and all components properly grounded	☐	☐	
PF19	Safety devices mounted and functional	☐	☐	
*Type: centrifugal, plug-in, direct driven motor, other				
☒- **Cooler (water)**		☐	☐	
PH01	Coils properly connected (in the counter flow or according specs).	☐	☐	
PH02	Media_____ according to specs, available, installation flushed, free of air and under pressure	☐	☐	
PH03	Coils are clean and fins are in good condition	☐	☐	
PH04	Valves mounted, in proper direction Valve type: _____ Valve actuator type: _____	☐	☐	
PH05	3-way valve , in proper direction Valve type: _____ Valve actuator type: _____	☐	☐	
PH06	Valve open/close completely, no leaks on close position	☐	☐	
PH07	Piping done, flow direction correct, pipes supported, fittings mounted and labeled	☐	☐	
PH08	Thermal insulation of piping properly installed and according to specification	☐	☐	
PH09	All condensate drain pans clean and slope to drain, per spec	☐	☐	
PH10	Strainers in place and clean, blow down installed	☐	☐	
PH11	Condensate drains done (connection to drain proper, siphons properly mounted and filled with water)	☐	☐	
☒- **Cooler (evaporator)**		☐	☐	
PI01	Media_____ according to specs, available, installation flushed, free of air, moisture and under pressure	☐	☐	
PI02	Coils are clean and fins are in good condition	☐	☐	
PI03	Thermostatic / electronic expansion valves mounted Valve type: _____ Bulb type: _____	☐	☐	
PI04	Solenoid valves mounted Valve type: _____	☐	☐	

PI05	Valve open/close completely, no leaks on close position	☐	☐	
PI06	Piping done, flow direction correct, pipes supported, fittings mounted and labeled	☐	☐	
PI07	All condensate drain pans clean and slope to drain, per spec	☐	☐	
PI08	Strainers in place and clean, blow down installed	☐	☐	
PI09	Condensate drains done (connection to drain proper, siphons properly mounted and filled with water)	☐	☐	
Compressors (RAC system)		☐	☐	By circuits. Total no. of circuits (K):
PK01	Layout of compressors, coils, solenoid, TEX valves, receivers and other fittings correct, according to schemes and specs	☐	☐	/ /
PK02	TEX valve bulb and external pressure release mounted properly	☐	☐	/ /
PK03	Refrigerant filling according to pressures in specs, and conditions in installation	☐	☐	/ /
PK04	Thermal insulation of piping properly installed and according to specification	☐	☐	/ /
PK05	Sight glass without visible bubbles	☐	☐	/ /
PK06	Moisture drier without indicated moisture	☐	☐	/ /
PK07	Control and safety devices properly mounted, connected to automatic control system and functional	☐	☐	/ /
PK08	Leakage test completed, no leakage detected	☐	☐	/ /
PK09	Noise and vibrations in normal level and acceptable	☐	☐	/ /
PK10	Compressor delay set to max. 10 start-ups in hour	☐	☐	/ /
PK11	Input voltage (by phases). Allowed ±10% on all phases	☐	☐	1K measured: / / 2K measured: / / 3K measured: / /
PK12	Deviation of voltage on motor in %. < 2% allowed	☐	☐	
PK13	Current drawn on nominal load	☐	☐	1K nominal: measured: 2K nominal: measured: 3K nominal: measured:
PK14	Motor current on maximal load (measured after the frequency converter)	☐	☐	1K measured: / / 2K measured: / / 3K measured: / /
PK15	Measured current < Current on nominal load	☐	☐	/ /
PK16	Crankcase heater connected and functional	☐	☐	/ /
PK17	Compressor type	☐	☐	/ /
PK18	Oil type	☐	☐	/ /
PK19	Oil level in crankcase correct. Document the level	☐	☐	/ /
PK20	Refrigerant type	☐	☐	/ /
PK21	Quantity of refrigerant in kg (according to specs)	☐	☐	/ /
PK22	Quantity of refrigerant in kg (filled in)	☐	☐	/ /
PK23	Evaporation temperature ^{o}C	☐	☐	/ /
PK24	Condensing temperature ^{o}C	☐	☐	/ /
PK25	Overheating temperature ^{o}C	☐	☐	/ /
PK26	Sub cooling temperature ^{o}C	☐	☐	/ /
PK27	Tension	☐	☐	/ /
PK28	Nominal current of compressor in A (according to specs)	☐	☐	/ /
PK29	Measured compressor current in A	☐	☐	/ /
PK30	(HP) High pressure switch	☐	☐	/ /
PK31	(LP) Low pressure switch	☐	☐	/ /
PK32	Connection of all electrical parts according to standards and attached wiring diagrams and schemes	☐	☐	
PK33	Protection of cables in cable trays done properly	☐	☐	
PK34	Service switches mounted and labeled	☐	☐	
PK35	All electrical connections tightened	☐	☐	
PK36	Device and all components properly grounded	☐	☐	
PK37	Safety devices mounted and functional	☐	☐	
Heater (water, steam)		☐	☐	Type*:
PG01	Coils properly connected (in the counter flow or according specs).	☐	☐	
PG02	Media_____ according to specs, available, installation flushed, free of air and under pressure	☐	☐	
PG03	Coils are clean and fins are in good condition	☐	☐	

PG04	Valves mounted, in proper direction Valve type: _____ Valve actuator type: _____	☐	☐	
PG05	3-way valve , in proper direction Valve type: _____ Valve actuator type: _____	☐	☐	
PG06	Valve open/close completely, no leaks on close position	☐	☐	
PG07	Piping done, flow direction correct, pipes supported, fittings mounted and labeled	☐	☐	
PG08	Thermal insulation of piping properly installed and according to specification	☐	☐	
PG09	All condensate drain pans clean and slope to drain, per spec	☐	☐	
PG10	Strainers in place and clean, blow down installed	☐	☐	
PG11	Condensate drains done (connection to drain proper, siphons properly mounted and filled with water)	☐	☐	
PG12	All condensate drain pans clean and slope to drain, per spec	☐	☐	
PC01	**Circulating pump** mounted Pump type: _____	☐	☐	
PC02	Pump motor properly connected. Rotation direction checked and correct	☐	☐	
PC03	Pump motor thermal protection properly mounted and set	☐	☐	
PC04	Input voltage (by phases). Allowed ±10% on all phases	☐	☐	Measured: / /
PC05	Deviation of voltage on motor in %. < 2% allowed	☐	☐	
PC06	Current drawn on nominal load	☐	☐	Nominal: Measured:
PC07	Pump motor current on maximal load	☐	☐	Measured: / /
PC08	Measured current < Current on nominal load	☐	☐	
PC09	Connection of all electrical parts according to standards and attached wiring diagrams and schemes	☐	☐	
PC10	Protection of cables in cable trays done properly	☐	☐	
PC11	Service switches mounted and labeled	☐	☐	
PC12	All electrical connections tightened	☐	☐	
PC13	Device and all components properly grounded	☐	☐	
PC14	Safety devices mounted and functional	☐	☐	
**Type: pre-heater, heater, re-heater, heater/cooler*				
Frost protection thermostat		☐	☐	
PT01	Mounted on: ☐ **coil fins** ☐ **frame**	☐	☐	
PT02	Properly mounted, connected to automatic control system and functional. Set up value set on +4 °C and checked Thermostat type: _____	☐	☐	
Heater (water, steam)		☐	☐	*Type:
PG01	Coils properly connected (in the counter flow or according specs).	☐	☐	
PG02	Media_____ according to specs, available, installation flushed, free of air and under pressure	☐	☐	
PG03	Coils are clean and fins are in good condition	☐	☐	
PG04	Valves mounted, in proper direction Valve type: _____ Valve actuator type: _____	☐	☐	
PG05	3-way valve , in proper direction Valve type: _____ Valve actuator type: _____	☐	☐	
PG06	Valve open/close completely, no leaks on close position	☐	☐	
PG07	Piping done, flow direction correct, pipes supported, fittings mounted and labeled	☐	☐	
PG08	Thermal insulation of piping properly installed and according to specification	☐	☐	
PG09	All condensate drain pans clean and slope to drain, per spec	☐	☐	
PG10	Strainers in place and clean, blow down installed	☐	☐	
PG11	Condensate drains done (connection to drain proper, siphons properly mounted and filled with water)	☐	☐	

PG12	All condensate drain pans clean and slope to drain, per spec	☐	☐	
PC01	**Circulating pump** mounted Pump type: _____	☐	☐	
PC02	Pump motor properly connected. Rotation direction checked and correct	☐	☐	
PC03	Pump motor thermal protection properly mounted and set	☐	☐	
PC04	Input voltage (by phases). Allowed ±10% on all phases	☐	☐	Measured: / /
PC05	Deviation of voltage on motor in %. < 2% allowed	☐	☐	
PC06	Current drawn on nominal load	☐	☐	Nominal: Measured:
PC07	Pump motor current on maximal load	☐	☐	Measured: / /
PC08	Measured current < Current on nominal load	☐	☐	
PC09	Connection of all electrical parts according to standards and attached wiring diagrams and schemes	☐	☐	
PC10	Protection of cables in cable trays done properly	☐	☐	
PC11	Service switches mounted and labeled	☐	☐	
PC12	All electrical connections tightened	☐	☐	
PC13	Device and all components properly grounded	☐	☐	
PC14	Safety devices mounted and functional	☐	☐	
**Type: pre-heater, heater, re-heater, heater/cooler*				
Frost protection thermostat		☐	☐	
PT01	Mounted on: ☐ **coil fins** ☐ **frame**	☐	☐	
PT02	Properly mounted, connected to automatic control system and functional. Set up value set on +4 °C and checked Thermostat type: _____	☐	☐	
Hydraulic module		☐	☐	
PU01	Coils properly connected (in the counter flow or according specs).	☐	☐	
PU02	Media_____ according to specs, available, installation flushed, free of air and under pressure	☐	☐	
PU03	Coils are clean and fins are in good condition	☐	☐	
PU04	Valves mounted, in proper direction Valve type: _____ Valve actuator type: _____	☐	☐	
PU05	3-way valve , in proper direction Valve type: _____ Valve actuator type: _____	☐	☐	
PU06	Valve open/close completely, no leaks on close position	☐	☐	
PU07	Piping done, flow direction correct, pipes supported, fittings mounted and labeled	☐	☐	
PU08	Thermal insulation of piping properly installed and according to specification	☐	☐	
PU09	No leakage detected	☐	☐	
PU10	Condensate drains done (connection to drain proper, siphons properly mounted and filled with water)	☐	☐	
PU11	Pressure test done according to procedure and standards	☐	☐	
PU12	Control and safety devices properly mounted, connected to automatic control system and functional	☐	☐	
PC01	**Circulating pump** mounted Pump type: _____	☐	☐	
PC02	Pump motor properly connected. Rotation direction checked and correct	☐	☐	
PC03	Pump motor thermal protection properly mounted and set	☐	☐	
PC04	Input voltage (by phases). Allowed ±10% on all phases	☐	☐	Measured: / /
PC05	Deviation of voltage on motor in %. < 2% allowed	☐	☐	
PC06	Current drawn on nominal load	☐	☐	Nominal: Measured:
PC07	Pump motor current on maximal load	☐	☐	Measured: / /
PC08	Measured current < Current on nominal load	☐	☐	
PC09	Connection of all electrical parts according to standards and attached wiring diagrams and schemes	☐	☐	
PC10	Protection of cables in cable trays done properly	☐	☐	
PC11	Service switches mounted and labeled	☐	☐	

PC12	All electrical connections tightened	☐	☐	
PC13	Device and all components properly grounded	☐	☐	
PC14	Safety devices mounted and functional	☐	☐	
Filter		☐	☐	*Type:
PF01	Filters clean and tight fitting	☐	☐	/
PF02	Filter mounted according to specs, labels of spare filters visible and attached	☐	☐	/
PF03	Filter pressure differential measuring device installed and functional (magnehelic, inclined manometer, etc.)	☐	☐	Type: /
PF04	Final pressure drop (Pa) set according to specs	☐	☐	Set: /
Filter		☐	☐	*Type:
PF01	Filters clean and tight fitting	☐	☐	/
PF02	Filter mounted according to specs, labels of spare filters visible and attached	☐	☐	/
PF03	Filter pressure differential measuring device installed and functional (magnehelic, inclined manometer, etc.)	☐	☐	Type: /
PF04	Final pressure drop (Pa) set according to specs	☐	☐	Set: /
Type: Supply 1, Supply 2, Exhaust 1, Exhaust 2 (in air direction)				
Dampers		☐	☐	*Position: /
PZ01	Damper mounted correctly and according to specs, set to proper initial position (closed)	☐	☐	/
PZ02	Label of damper blades position corresponds to position of damper blades	☐	☐	/
PZ03	Damper moves freely, close tightly	☐	☐	/
PZ04	Blades clean, sealing mounted and functional	☐	☐	/
PZ05	Damper connected to mechanism, bearings lubricated	☐	☐	/
PZ06	Proper damper actuator mounted, connected to automatic control system and functional	☐	☐	Type: /
Dampers		☐	☐	*Position: /
PZ01	Damper mounted correctly and according to specs, set to proper initial position (closed)	☐	☐	/
PZ02	Label of damper blades position corresponds to position of damper blades	☐	☐	/
PZ03	Damper moves freely, close tightly	☐	☐	/
PZ04	Blades clean, sealing mounted and functional	☐	☐	/
PZ05	Damper connected to mechanism, bearings lubricated	☐	☐	/
PZ06	Proper damper actuator mounted, connected to automatic control system and functional	☐	☐	Type: /
Position: Fresh air, Extract air, Recirculating air, Mixing 1, Mixing 2, Mixing 1, Mixing 2, Mixing 3, By-pass, by-bass recirculation, By-pass defrosting				
Plate heat exchanger		☐	☐	
PP01	Fins clean and in good shape	☐	☐	
PP02	Condensate drains done (connection to drain proper, siphons properly mounted and filled with water)	☐	☐	
Rotary wheel		☐	☐	
PR01	clean and in good shape	☐	☐	
PR02	Motor type and nominal data correspond to data on nameplates	☐	☐	
PR03	Rotation of wheel free and in direction according to indication on wheel housing	☐	☐	
PR04	Appropriate clearance between the wheel and the casing; sealing brushes adjusted	☐	☐	
PR05	All sensors and controls mounted properly, connected to automatic control system and functional Type of sensor: _____ Type of rotation control: _____	☐	☐	
PR06	Belt(s) properly installed and tensioned	☐	☐	
PR07	Cables installed sufficiently far from moving parts	☐	☐	
PR08	Motor properly connected. Rotation direction checked and correct	☐	☐	
PR09	Motor thermal protection properly mounted and set	☐	☐	

PR10	Input voltage (by phases). Allowed ±10% on all phases	☐	☐	Measured: / /
PR11	Deviation of voltage on motor in %. < 2% allowed	☐	☐	
PR12	Current drawn on nominal load	☐	☐	Nominal: Measured:
PR13	Motor current on maximal	☐	☐	Measured: / /
PR14	Measured current < Current on nominal load	☐	☐	
PR15	Connection of all electrical parts according to standards and attached wiring diagrams and schemes	☐	☐	
PR16	Protection of cables in cable trays done properly	☐	☐	
PR17	Service switches mounted and labeled	☐	☐	
PR18	All electrical connections tightened	☐	☐	
PR19	Device and all components properly grounded	☐	☐	
PR20	Safety devices mounted and functional	☐	☐	
	Air washer and honeycomb humidifier	☐	☐	
PV01	Honeycomb/nozzles clean and in good shape	☐	☐	
PV02	Water treatment installed Type of system: ____	☐	☐	
PV03	Quality of feed water (hardness, microbiological quality) checked with measures at authorized organization and according to specs	☐	☐	
PV04	Float valve and other fittings mounted, set, connected to automatic control system and functional Float valve type: ____	☐	☐	
PV05	Strainers in place and clean, blow down installed	☐	☐	
PV06	All condensate drain pans clean and slope to drain, per spec	☐	☐	
PV07	Condensate drains done (connection to drain proper, siphons properly mounted and filled with water)	☐	☐	
PV08	Valve open/close completely, no leaks on close position	☐	☐	
PV09	Piping done, flow direction correct, pipes supported, fittings mounted and labeled	☐	☐	
PV10	No leaks detected	☐	☐	
PV11	Pressure test done according to procedure and standards	☐	☐	
PV12	Control and safety devices properly mounted, connected to automatic control system and functional	☐	☐	
PC01	**Circulating pump** mounted Pump type: _____	☐	☐	
PC02	Pump motor properly connected. Rotation direction checked and correct	☐	☐	
PC03	Pump motor thermal protection properly mounted and set	☐	☐	
PC04	Input voltage (by phases). Allowed ±10% on all phases	☐	☐	Measured: / /
PC05	Deviation of voltage on motor in %. < 2% allowed	☐	☐	
PC06	Current drawn on nominal load	☐	☐	Nominal: Measured:
PC07	Pump motor current on maximal load	☐	☐	Measured: / /
PC08	Measured current < Current on nominal load	☐	☐	
PC09	Connection of all electrical parts according to standards and attached wiring diagrams and schemes	☐	☐	
PC10	Protection of cables in cable trays done properly	☐	☐	
PC11	Service switches mounted and labeled	☐	☐	
PC12	All electrical connections tightened	☐	☐	
PC13	Device and all components properly grounded	☐	☐	
PC14	Safety devices mounted and functional	☐	☐	
PC15	Safety system of pump operation „on dry“ mounted and functional	☐	☐	
	Steam humidifier	☐	☐	*Type:
PL01	Water treatment installed Type of system: ____	☐	☐	
PL02	Quality of feed water (hardness, microbiological quality) checked with measures at authorized organization and according to specs	☐	☐	
PL03	Steam separator and steam valve mounted, set and functional Steam separator type: _____ Steam valve type: _____	☐	☐	
PL04	Steam pipe, condense water drain pipe, steam	☐	☐	

	separation system properly mounted, connected to steam supply/drain			
PL05	Input voltage (by phases). Allowed ±10% on all phases	☐	☐	Measured: / /
PL06	Valve open/close completely, no leaks on close position	☐	☐	
PL07	Piping done, flow direction correct, pipes supported, fittings mounted and labeled	☐	☐	
PL08	No leaks detected	☐	☐	
PL09	Pressure test done according to procedure and standards	☐	☐	
PL10	Control and safety devices properly mounted, connected to automatic control system and functional	☐	☐	
PL11	Connection of all electrical parts according to standards and attached wiring diagrams and schemes	☐	☐	
PL12	Protection of cables in cable trays done properly	☐	☐	
PL13	Service switches mounted and labeled	☐	☐	
PL14	All electrical connections tightened	☐	☐	
PL15	Device and all components properly grounded	☐	☐	
PL16	Safety devices mounted and functional	☐	☐	
Type: electric steam generator, with external steam source				
Burners		☐	☐	
PJ01	Fins clean and in good shape	☐	☐	
PJ02	Media_____ according to specs, available, installation flushed, free of air and under pressure	☐	☐	
PJ03	Valve open/close completely, no leaks on close position	☐	☐	
PJ04	Piping done, flow direction correct, pipes supported, fittings mounted and labeled	☐	☐	
PJ05	No leaks detected	☐	☐	
PJ06	Burner engine mounted properly Burner type: ____ Control type: _____	☐	☐	
PJ07	Sensors, Control and safety devices properly mounted, connected to automatic control system and functional	☐	☐	
PJ08	Connection to gas/oil installation and chimney done properly and tester for leaks; no leaks detected	☐	☐	
PJ09	Set up values of operation and safety thermostat set and checked Set up value of operation thermostat: _____ Set up value of safety thermostat: _____	☐	☐	
PJ10	Connection of all electrical parts according to standards and attached wiring diagrams and schemes	☐	☐	
PJ11	Protection of cables in cable trays done properly	☐	☐	
PJ12	Service switches mounted and labeled	☐	☐	
PJ13	All electrical connections tightened	☐	☐	
PJ14	Device and all components properly grounded	☐	☐	
PJ15	Safety devices mounted and functional	☐	☐	
Electric heater		☐	☐	
PE01	Heater bars clean and in good condition	☐	☐	
PE02	Stages connected to wiring scheme or specs	☐	☐	
PE03	Thyristor regulation present, properly mounted, connected to automatic control system and functional Thyristor type: _____	☐	☐	
PE04	Input voltage (by phases). Allowed ±10% on all phases	☐	☐	Measured: / /
PE05	Sensors, Control and safety devices properly mounted, connected to automatic control system and functional	☐	☐	
PE06	Set up values of operation and safety thermostat set and checked Set up value of operation thermostat: _____ Set up value of safety thermostat: _____	☐	☐	
PE07	Connection of all electrical parts according to standards and attached wiring diagrams and schemes	☐	☐	
PE08	Protection of cables in cable trays done properly	☐	☐	

PE09	Service switches mounted and labeled	☐	☐	
PE10	All electrical connections tightened	☐	☐	
PE11	Device and all components properly grounded	☐	☐	
PE12	Safety devices mounted and functional	☐	☐	
Additional checks		☐	☐	
Outdoor unit installation		☐	☐	
PD01	Design of drip trim and frost protection (drop trim heaters, siphons) proper and functional	☐	☐	
PD02	Damper blades heater (according to specs) properly mounted, connected to automatic control system and functional	☐	☐	
PD03	Roof properly mounted and sealed	☐	☐	
PD04	Thermal insulation of piping properly installed and according to specification	☐	☐	
PD05	All electric devices and components protected properly from atmospheric conditions (sealing, installation in protection boxes etc.) and in appropriate protection class	☐	☐	
PD06	All joint exposed to potential water penetration are sealed properly with sealing or closed with covers, plugs etc.	☐	☐	
Units in hygienic design		☐	☐	
PT01	Proper air tight dampers acc. to DIN 1946-4 mounted	☐	☐	
PT02	Sealing of joints done with silicon-free sealant	☐	☐	
PT03	Protective floor covers mounted and properly sealed	☐	☐	
PT04	Filters of appropriate class (according to specs) set after initial start-up	☐	☐	
PT05	All internal surfaces of unit cleaned well from dirt, moisture, deposits etc.	☐	☐	
ATEX units		☐	☐	
PQ01	Used measuring, control and safety devices for automatic control have appropriate labels on casing and valid ATEX certificate	☐	☐	
PQ02	Compliance according to safety regulations done and CE mark set by owner/end customer	☐	☐	
Other check		☐	☐	
PX01	All internal surfaces of unit cleaned well from dirt, moisture, deposits etc.	☐	☐	
PX02	TAB done according to specs or TAB expert	☐	☐	
PX03	External pressure drops and air volume flows of supply/exhaust air checked and according to spec	☐	☐	
PX04	Additional checklist are done and documented	☐	☐	
PX05		☐	☐	

Air Handling Unit Start-up Checklist

Check if acceptable, provide comment if unacceptable (NA)			NA	**Comment**
Control panel		☐	☐	
PU01	Fuses properly sized and mounted	☐	☐	
PU02	All control systems wired completely and connected (sensors etc.)	☐	☐	
PU03	Signals checked	☐	☐	
PU04	Functional test of sensors done	☐	☐	
PU05	All electric wires properly blanked, inserted into components, labeled clearly on both sides of the wire	☐	☐	
PU06	All non-used cable inlet holes properly covered with rubber plugs	☐	☐	
Automatic control components		☐	☐	
PA01	Fire detectors on place	☐	☐	
PA02	Sensors and temperature, pressure and flow transmitters mounted	☐	☐	

PA03	Measured values in installation and communication, and corresponding temperatures and pressures matches	☐	☐	
PA04	DDC regulator functionally tested	☐	☐	
PA05	Calibration of sensors done	☐	☐	
PA06	Functional test according to list of signals done	☐	☐	
PA07	Functional test according to Modbus list done	☐	☐	
PA08	Security settings and codes for access set acc. to specifications and documented	☐	☐	
PA09	Owner/End customer service and maintenance personal available for providing the basic instruction for work. Training for end customer done Name and surname of trained person:: _____	☐	☐	

Sensor calibration					
Sensor type	Position	Position OK?	Measured value	Factory/ Default set-up value	Acceptable? Comments
Fresh air					
Temperature in °C					
Rel. Humidity in %					
Supply air					
Temperature in °C					
Rel. Humidity in %					
Extract air					
Temperature in °C					
Rel. Humidity in %					
Exhaust air					
Temperature in °C					
Rel. Humidity in %					
Recirculated air					
Temperature in °C					
Rel. Humidity in %					
Air in space					
Temperature in °C					
Rel. Humidity in %					
Other					

REMARK: it is recommended to copy a blank checklist near compressor (integrated cooling) and fill in a copy during the preparation for start-up

Record sheet for refrigerant gases

General Information					
Plant Operator (Name, address, Telephone)					
Operator Contact:					
Plant Name:			**Reference No.**		
Location of Plant:					
Customers ref.:					
Our ref. No.::			**System:**		
Unit type :					
Serial No.:			**Year of production:**		
Refrigerant Type		**Refrigerant Quantity (Kg)**			
Plant Manufacturer			**Date of Installation**		

Refrigerant Additions					
Date	**Technician / Company**	**Amount Added (Kg) By circuits (K1, K2, K3)**			**Reason for Addition**

Refrigerant removal					
Date	**Technician / Company**	**Amount Added (Kg) By circuits (K1, K2, K3)**			**Reason for Removal**

Leak Tests		
Date	**Technician / Company**	**Test Result (Including location, follow up action required and cause of any leaks identified)**

Follow-up Action			
Date	**Technician / Company**	**Related to test (date)**	**Action Taken**

Sheet Number_____ Not to be removed from the site where this plant is situated. ___ List attached

PROKLIMA_KU_F-GASES RECORD SHEET _V1.2_hr

REMARK: it is recommended to copy a blank checklist near the unit and fill in a copy during the preparation for start-up

Air Handling Unit Logbook

Client:			
Project:			
Customers ref.:			
Our ref. No.:		**System:**	
Unit type :			
Serial No.:		**Year of production:**	

WARNING

It is forbidden to operate the unit if some parts of casings have been dismounted from individual components or sections

The main power supply must not be turned on before the unit has been connected to the safety system and grounded.

It is forbidden to carry out service and maintenance operations if the power supply is not disconnected.

Always use personal protective equipment.
Beware of sharp edges of the filter frames

The time schedule recommended below represents a framework recommendation of the unit manufacturer only and does not represent necessarily a rule for all methods of applying the unit. The check, cleaning and repair intervals are to be adjusted to actual needs, possibilities, regulations and the situation on site, as well as to the method and intensity of using the unit.

The records of done service and maintenance work should be available for service personal and kept near the unit.

Date of initial start-up:	

Type (check period): (R – Regularly, P – periodically, A - Annually)

Next periodical check	Type	Comments

Next periodical check	Type	Comments

Service records

Date	Technician / Company	Comments

___ List attached

PROKLIMA

ISO 9001
BUREAU VERITAS
Certification

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